SCIENTIFIC AMERICAN

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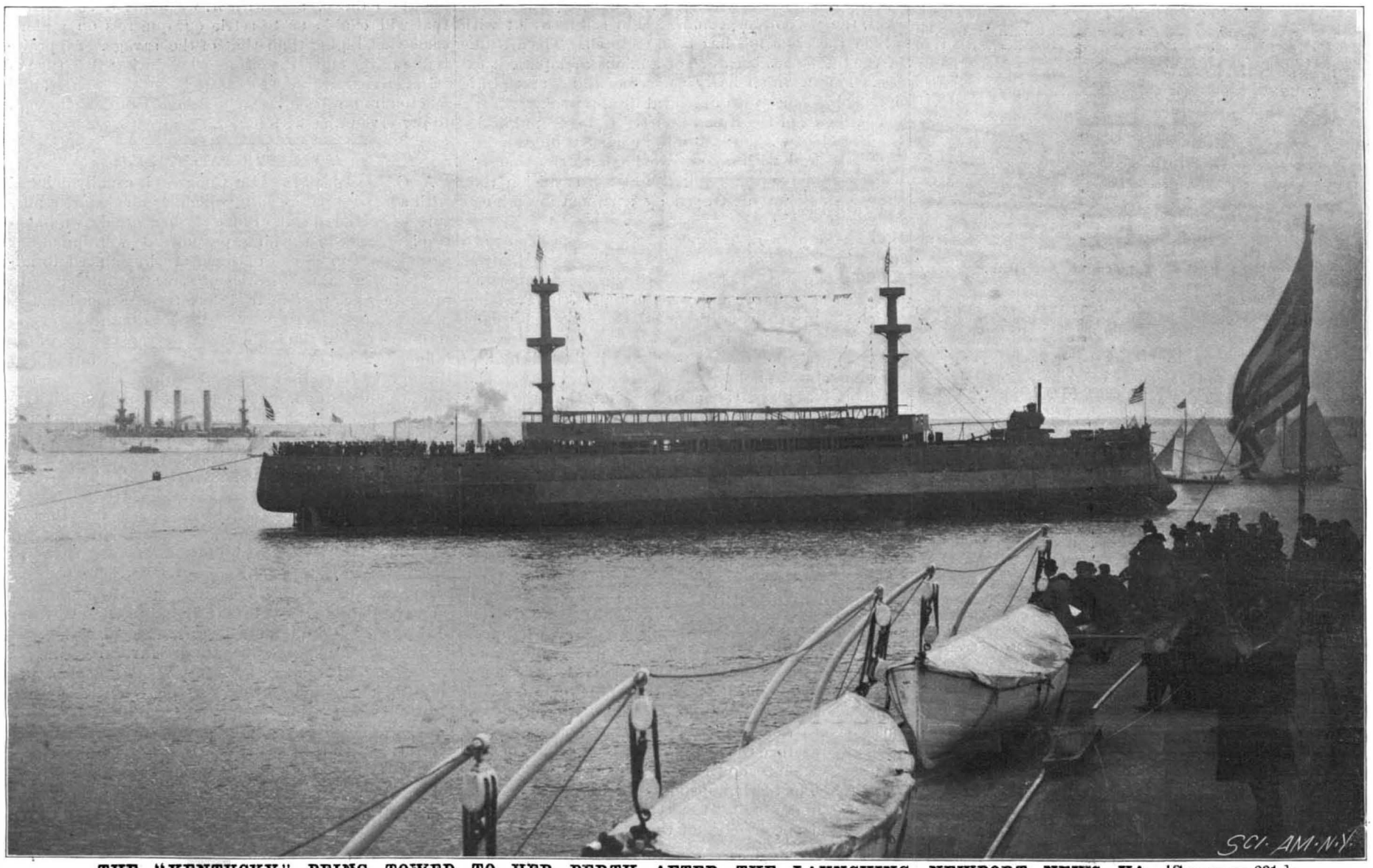
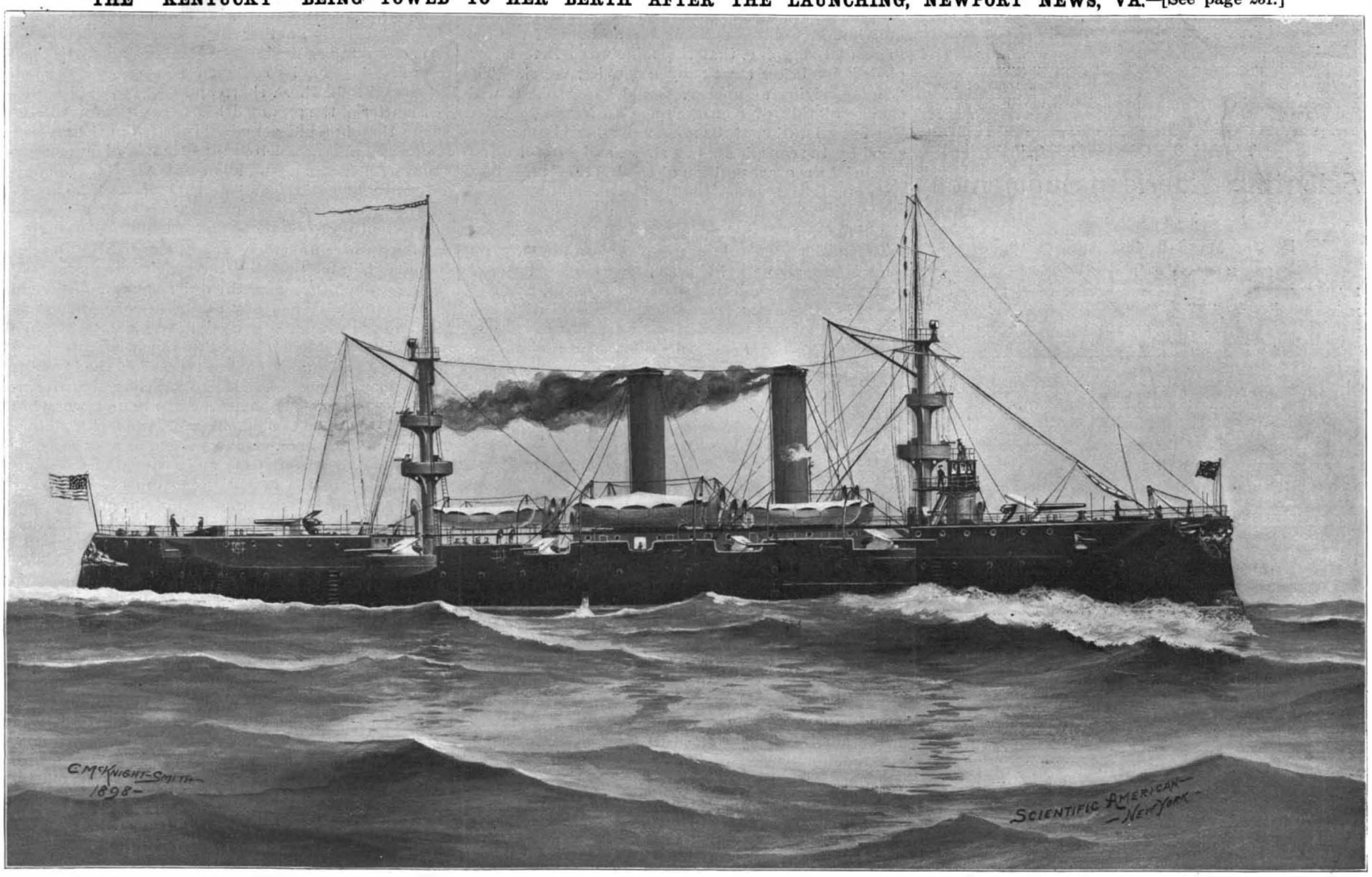


THE "KENTUCKY" BEING TOWED TO HER BERTH AFTER THE LAUNCHING, NEWPORT NEWS, VA.—[See page 231.]



NEW UNITED STATES CRUISER "NEW ORLEANS," FORMERLY "AMAZONAS," OF THE BRAZILIAN NAVY.—[See page 231.]

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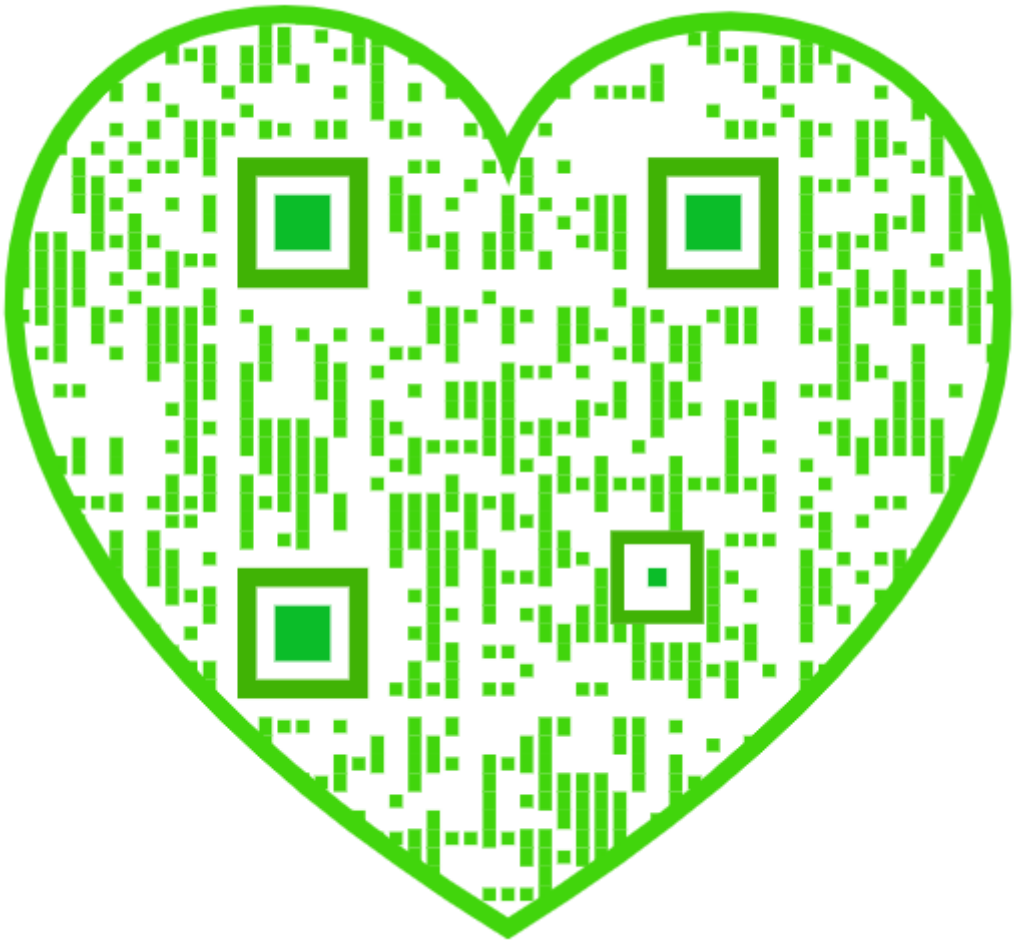

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THE OFFICIAL REPORT OF THE "MAINE" DISASTER.

It is not within the province of the SCIENTIFIC AMERICAN to discuss the political aspects of the problem which confronts this country with regard to Cuba. It is not for us to determine whether the present condition of this unhappy island, blighted as it is by all the miseries of a two years' war, can be considered as affording a *casus belli* between ourselves and Spain.

The blowing up of the battleship "Maine," however, presents a problem of an entirely different complexion—one that has touched the nation to the quick. How deeply we have felt the loss, and appreciate the terrible circumstances attending it, is shown by the significant, the portentous, calmness and self-restraint with which the situation has been endured. The attitude of the public has been one of anxious and patient expectation, in which hasty conclusions and precipitate actions have met with universal disapproval.

The report of the Naval Court was made public by the President without a word of comment on Monday, March 28, and with regret we have to say that the worst fears have been realized and the suspicion that the "Maine" was destroyed by a submarine mine is fully confirmed.

The summary of the official report has been published in the daily press and is already widely known.

On another page we reproduce the most important drawings which accompany the report, by studying which the present condition of the wreck will be made perfectly clear to our readers.

The appearance of the wreck, as indicated by the drawings, proves not only that the ship was wrecked by explosives placed beneath her, but that the mine must have been of vast size and power. No automobile torpedo could have blown the central portion of the hull out of existence and forced the keel at frame 18 right up through the body of the ship through a vertical distance of thirty-four feet. We have on record, thanks to the Chilean war, concrete evidence of what effect a Whitehead torpedo will have against the hull of a ship like the "Maine." In that war the "Blanco Encalada" was struck below the water line, at about the same point on the port bow as the "Maine," by a torpedo carrying 175 pounds of guncotton. The result was a horizontal rent in the plating, twenty-five feet in length and not over five feet in width at the widest part. The ship was raised and repaired, the injury being quite local. If it took 175 pounds of guncotton to produce a local rent in the "Blanco Encalada," it must have taken a simply enormous amount of explosive to produce the awful wreck of the hull of the "Maine" which is shown in the official drawings referred to. The tearing open and throwing back of the decks was undoubtedly the result of the subsequent explosion of one or more of the magazines within the ship.

The scale on which the scheme of destruction was carried out was too elaborate for execution by private individuals, and it is unlikely, on account of the risk to general shipping, that the mine was left to be exploded by being struck by a moving vessel. The "Maine," lying at anchor, would swing about with change of tide over an arc some 700 feet in diameter. The exact location of the mine must have been understood by the conspirators on shore, and careful observation of the exact position of the "Maine" must have been obtained in order that the mine could have been electrically exploded at the exact moment at which the ill-fated battleship floated over the fatal spot.

The authors of this horrible catastrophe are unknown. In all probability the solution of the question will ever remain a mystery. It seems, however, impossible that a mine containing many hundred pounds of guncotton or similar explosive could have been placed under the vessel after she was anchored there. If a mine had been placed there before this particular point of anchorage had been selected, it must have been with the knowledge of the authorities. The fact that this place of anchorage was an unusual one and that, according to the reported evidence of Capt. Stevens, of the "City of Washington," it was the least used buoy in the harbor, and no warships had been moored there, to his knowledge, for five or six years, lends food for a terrible suspicion. It is doubtful, however, after all has been said and done, whether the circumstantial evidence surrounding the case can do any more than suggest a strong suspicion of complicity on the part of some individuals who were familiar with the harbor and the conditions existing there. It is probable before this issue, on which we are now going to press, is published that the question of war or peace arising out of the political questions before mentioned will have been decided upon. Should this not be the case, we see no reason why the question of the "Maine" explosion should not be adjusted consistently with our honor and the humiliation of Spain, without the terrible arbitrament of the sword.

It does not seem to us that indemnity for the loss of the "Maine" would be an improper course for us to take. It is certain, however, that whatever form of indemnity may be determined upon, it must include the ultimate independence of the island of Cuba. We speak of indemnity, not because we feel that the loss of the poor fellows on the ill-fated battleship is one which can be determined in cold dollars and cents; not because we feel that a punitive award would repay us for the loss of the noble vessel under such circumstances; not because it is possible that an affair in which one's honor is involved can be treated as a commercial contract, but because this is the end of the nineteenth century and the time has been reached when differences, no matter how great their gravity, arising between nations as between individuals should be settled in some other manner than by force of arms. We have reached the period when a new century is about to dawn, and with it, we hope, a civilization that will enable us to settle our quarrels on a plane somewhat higher than that of the savage. All praise is due to the chief executive, who, during this time of crisis, has taken a wise and honorable course, and whose aim has been, as we believe it will be to the end, to preserve peace with honor.

A "QUEER" PATENT BILL.

At this season of the year Congress is usually deluged with a mass of patent bills, which, as a rule, are a mixture of good and evil. Some of them are drawn in entire ignorance of the aims, purposes or working of our patent system. Some of them are introduced to advance the peculiar theories of some enthusiast or to promote the particular interests of some locality. Some are introduced by members of Congress in good standing, but at the request of some constituent whose influence may not be disregarded. Some are introduced through motives that it would require the art of the Magi to understand, and some through no motive at all. We yearly take occasion to comment upon some of these freak bills. This year we have not given this class of legislation the usual attention, owing to war and rumors of war and other matters that have needed urgent attention.

One of the bills that falls within one or the other of the kinds of legislation referred to above is H. R. 5764, introduced by Mr. Reeves. This bill provides that any one may manufacture, sell and use a patented invention upon obtaining permission so to do from the Commissioner of Patents. The inventor is required, before the issue of the patent, to file a sworn statement of the estimated cost of manufacture "under favorable circumstances, and with proper machinery." Any person, corporation or manufacturing company shall have the right to begin to manufacture under the patent, *with or without the consent of the owner of the patent*, upon depositing with the Commissioner a sum not less than one percentum and not more than ten percentum of such estimated cost of manufacture. There is graciously included a provision, beautifully bound with red tape, whereby a fraction of the money thus deposited shall actually be paid to the patentee. Lest the inventor might be influenced by what Poe called "the Imp of the Perverse," and demur to the benevolence thus bestowed on him, there is another little joker provided in the form of an undisguised threat, and his patent is open to proceedings for its condemnation—proceedings well calculated to be short, sharp and decisive. If the subject matter of the proposed law were encountered elsewhere than in a bill actually presented in Congress, it might well pass as a delightful example of humor peculiarly American. Thus, any one having an acquaintance with inventions and patents knows, if he knows anything, that it is very often rather desirable to obtain patent protection here and in Europe before submitting the invention for estimates of the cost of "proper machinery," and that the "favorable circumstances" will depend on the size of the orders he can dispose of to the public. When any competitor may manufacture and sell without any cost of experimentation (the inventor having done all the experimenting), the large orders and "favorable circumstances" of the inventor will be made impossible. It is very clear that the inventor's "favorable circumstances" are not worrying the sponsors. The Commissioner of Patents is required to keep accounts, not of one person, firm or corporation, but of all persons, firms and corporations seeking to manufacture the inventions of others—a pleasing prospect to an official who is not given assistants enough to carry on expeditiously the ordinary routine business of the office. The Commissioner, under the provisions of this bill, however, would be expected to possess not only the vast knowledge and learning and experience that is now looked for in the incumbent of that office, but he will require an intellectual equipment far transcending the marvelous endowments of the all-wise Solomon; for he will be called upon to tell at a glance the proper value and fix a fair royalty upon the 20,000 or more patents which are issued annually. As every one knows who has had any experience in patent matters, there is no more difficult matter to determine than the market value of an untried or undeveloped invention. Merit alone does not enable one to determine such a value, as it is necessary that there should be a market; and the market value will fluctuate with the extent and nature of the demand, and with the character and financial resources of those who seek to obtain possession of the rights under the patent.

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There is no danger, however, that such a bill will become a law. Before such a measure could receive favorable consideration in Congress, some member would doubtless rise on the floor of the House and would remind that body that the inventors are not the only class benefited by wise patent laws. Such a one could not do better than use the words of the Hon. Thos. A. Jenckes in an earnest address in Congress on April 22, 1870, delivered in defense of our patent system, in which he said :*

"Now every invention published through the Patent Office adds something to our knowledge, and, if useful, increases the material wealth of the world. And I do not hesitate to say that the sum of these values, the aggregate increase to the wealth of this country, from the inventive genius of the people fostered and protected by the patent laws, has been greater than that derived from the protective tariffs passed since the government was organized under the Constitution."

ANOTHER BILL.

Of a similar character with the above bill may be mentioned Senate Bill 4239, introduced "by request." This bill is designed to fix the statute of limitation within which suit must be brought for infringement of a patent to a very short period. Anyone owning a patent or an interest in a patent must bring suit against any inventor or manufacturer infringing his patent within a term of one year from the date of said infringement. The hardship of such a provision need not be dwelt upon by us. Our country is a very vast one and extends over a territory of 3,000 miles from shore to shore. Still an inventor living in a remote portion of the country, perhaps, must begin suit against an infringing manufacturer within one year, or forever lose all right to recover either damages or royalty for the use of his invention, even though he may be in entire ignorance of said infringement. What is still more flagrant, he "is forever debarred from collecting damage from said . . . manufacturer." Such a bill puts the impecunious inventor living in the country, who is unaware what progress and development is being made in the industrial world, entirely at the mercy of the manufacturing community. This is an exception to the old saw, "Where ignorance is bliss 'tis folly to be wise." A manufacturer might surreptitiously manufacture a patented article and put it on the market in a remote section of the country, so that its introduction would not be known, and still, after having had the articles on sale for a year, he becomes owner of the patent in so far that, henceforward, he may continue the manufacture of same unmolested, and the inventor, as against such infringer, has no standing in court. Such a bill, if made a law, would bring about a system of such gross abuse and dishonesty as to serve in a little while to overturn our entire patent system.

THE SUBMARINE TORPEDO BOAT.

Rightly or wrongly, the naval world believes that the production of a successful submarine torpedo boat will mark the greatest revolution that has ever occurred in naval warfare. The change from sails to steam, the introduction of armor plate, the breechloading gun, the advent of the torpedo and the torpedo boat, have all in their turn produced radical changes in the construction and the tactics of war vessels, but not any one of them has ever produced the upheaval of long-established customs or the distrust of accepted theories which will occur on the day that a thoroughly practical submarine boat makes its appearance.

There is a general belief that an effective under-water warship would have the above-water ship at its mercy, and we think the belief is well founded.

Of all naval devices that have been made the object of painstaking invention, there is probably none whose history at once dates back so far and includes so many repeated and heartbreaking failures. We say this with the knowledge that submarine boats have been built which have contained many of the elements indispensable to success. Unfortunately, in most cases there have been defects which ultimately relegated the device to the rubbish heap. The reason for this is not far to seek. Submarine navigation and warfare are in the nature of things so difficult, are beset with so many contingencies, that the ships in which they are carried on must be marvels of ingenuity and constructive skill and must meet a number of exacting requirements which never trouble the designer of a ship of the ordinary type.

For instance, in these days of 20-knot warships with their great helm power, a successful submarine boat must be swift and capable of rapid maneuvering. It must be able to run at various degrees of submersion without any liability either to plunge or to rise to the surface. It must be capable of maintaining the same course after diving as it was holding on the surface. It must be capable of approaching the enemy unseen, or, if any part of it be visible, it must be so small as to be safe from destruction by rapid-fire guns. The boat should be large enough to contain a full crew and abundance of ammunition, for there is no reason to suppose that submarine artillery will miss the mark less frequently than that in use above water. Moreover, the motive power must be of a kind that will not fill the vessel with poisonous products of combustion, and, above all, an absolutely reliable system of air supply must be provided for the crew.

In the century or more which has elapsed since serious attempts were first made to build a submarine boat, America has played an important part, the first at all practicable vessel being built toward the close of the last century by Bushnell. This tiny craft all but succeeded in destroying the British ship "Eagle," and, considering the time in which it was built, there is more credit to be given to Bushnell's boat than any of its successors, which have had the experience of their predecessors to guide them.

The celebrated Fulton was the next to grapple with the problem, and the story of his "Nautilus" is well known. Philips' boat, launched in 1851 on Lake Michigan, deserves notice, and next to that came the French boat "Le Plongeur." The destruction of the United States steamer "Housatonic" by a submarine boat showed the tremendous possibilities of this form of warfare. Passing by several more or less successful attempts after the civil war, we come to the celebrated Nordenfeldt boat, and later that of Goubet. Considerable claims are made for these craft and for the French boats, "Zedè" and "Gymnota," and the Spanish boat "Peral." It is for obvious reasons difficult to obtain accurate information regarding the performances of these vessels ; but the fact that they are not being built in any numbers suggests that their success has been limited.

The Holland boat, which is described elsewhere in our columns, is the last of several that have been built by the inventor during the past twenty years. It embodies the results of a wide experience, and its trials indicate that the type contains all the elements of success. The larger boat, the "Plunger," now completing at Washington, will have speed, great offensive power and a wide radius of action. It will be capable of joining a fleet, cruising with it and forming part of the line of battle.

It is scarcely necessary to point out the deadly execution which could be wrought by such a vessel, not merely at night, but in an open battle by day upon the high seas. If the ordinary torpedo boat destroyer, which makes its dash upon the enemy in the open at the risk of being sunk by gun fire, is so dreaded by the larger warships, what shall be said of a torpedo boat which can sink beneath the waves and deliver half a dozen torpedoes from an unseen and unassailable position ?

If it is deadly by day and in the open, it will be doubly so by night. No searchlight would be powerful enough to detect the insignificant conning tower of an approaching submarine boat before it was well within striking range. No roadstead would be secure from its attack, and no fleet would dare to enter a harbor defended by these invisible, swiftly moving and destructive little craft; indeed, it is difficult to imagine just what would happen if a flotilla of these deadly little vessels were dispatched against a fleet of the enemy's ships.

* This address is published in full in this week's SUPPLEMENT.

THE WELSBACH PATENT SUSTAINED.

The decision of Judge Townsend, a justice of the United States Circuit Court, on March 25, in the matter of the Welsbach Light Company vs. the Sunlight Incandescent Lamp Company, issues an injunction against the latter company and calls for an accounting. It is the first decision rendered by the courts, other than temporary injunction cases, wherein the Welsbach interests have sought to prevent others from manufacturing mantles. The case was based on what is known as the Rawson patent, which recites a method of treating mantles so that the strength of the material and the durability of form is imparted to the fragile incandescing hood. The Rawsons were practical men and were prompt to recognize that the mantles required supplementary treatment to render them rigid so that they could be transported safely.

It was found that paraffine answered the purpose, and this use of paraffine or other suitable material was patented. The defendants set up that they were not employing paraffine or any of its equivalents, using "a solution composed chiefly of collodion with the addition of a small percentage of castor oil."

Judge Townsend disregards the whole question of material, and says sweepingly :

"The invention of the patent in suit transferred the Welsbach mantle from a laboratory experiment into an article of commerce : that it has successfully overcome the obstacles previously encountered, and has accomplished results quite as important as the original Welsbach invention, is admitted. . . . For these reasons this patent should not be narrowly interpreted, but should be so construed as to cover a broad range of equivalents. . . . While collodion is not chemically an equivalent of a hydrocarbon resin gum, and is not paraffine or shellac, it performs the same function in the same manner and with the same result."

In short the court protects the result without regard to the materials which may be employed to attain that result. The decision will be far-reaching in its effects and will tend to the good of the incandescent gas industry.

THE BILL TO INCREASE THE PATENT OFFICE FORCE.

The inventors and manufacturers of the country will learn with gratification that the bill for providing a moderate increase in the Patent Office force, which was more fully referred to editorially in the SCIENTIFIC AMERICAN of April 2, is meeting with strong official support, which is likely to secure its enactment into law. The Commissioner of Patents under date April 16 states that the members of the Senate Committee on Patents admit the urgency of the relief asked for in the bill. The passage of the bill will, without doubt, remedy the delay which now occurs in the examination of patent applications. The following urgent letter of the Commissioner sets forth the condition of the case:

DEPARTMENT OF THE INTERIOR,
UNITED STATES PATENT OFFICE,
WASHINGTON, March 18, 1898.

MY DEAR MR. SECRETARY : Referring to my conversations with you relative to an increased force for this office, I wish to report that Senator O. H. Platt, at my suggestion, introduced the bill in the form of an amendment to the sundry civil appropriation bill. I had a hearing before the committee yesterday. Every member of the committee present admitted the urgent necessity for the relief we asked for, but doubted the advisability of putting it into that appropriation. Upon their suggestion Senator Platt yesterday afternoon introduced the bill as Senate bill 4168.

I wish you would send to Senator O. H. Platt at the earliest possible moment your approval of the measure. The passage of the bill would without doubt result in the earlier issue of patents and enable a more complete and thorough examination to be made, thereby preventing the issue of many worthless patents. The public would be the gainers by this, and manufacturers and inventors certainly would be greatly assisted and pleased, because they would have their applications passed to issue in better form and at an earlier date.

In 1886 there were 188 examiners in this office, and at the present time there are 200. The number of applications received in 1886 was 35,968 ; in 1897 the number was 47,905. There was, as you will see, an increase in work of about 33 per cent, while the increase in force is only 6 per cent. Each examiner in 1897 did at least 17 per cent more work than in 1886.

These are a few of the reasons which lead me to ask you to make the indorsement as strong as possible.

I remain, very respectfully, yours,

Hon. C. N. BLISS, Secretary of the Interior. — C. H. DUELL, Commissioner.

It is unnecessary to say that the bill has received the unqualified approval of the Secretary of the Interior, who wrote an urgent letter to Senator Platt, as suggested in the letter of the Commissioner.

NAVAL APPROPRIATION BILL PASSED.

A bill appropriating a sum of $39,000,000 for naval purposes has been passed by the House. The alacrity with which this important measure was disposed of was prompted, no doubt, by the extremely critical condition of our relations with Spain and the growing impression that hostilities might be precipitated at an early date. The bill authorizes the construction of three first-class battleships of about 12,000 tons displacement, together with twelve torpedo boats and twelve torpedo boat destroyers. The original recommendation, as it came before the House, called for three battleships, six torpedo boats and six destroyers. An amendment was offered to strike out two battleships and double the number of torpedo craft; but, fortunately, while the latter part of the suggestion was followed, no reduction was made in the number of battleships. When these ships have been built, we shall possess twelve first-class battleships and between three and four dozen torpedo craft, large and small.

RELIEF FOR CUBAN FAMINE SUFFERERS.

The Central Cuban Relief Committee, appointed by the President of the United States, in this city, is undertaking an excellent work in securing contributions of food, clothing, etc., for the famine sufferers in Cuba, and is planning to load a ship to be dispatched as soon as possible, which is to be called the "New York and New Jersey Relief Ship."

The graphic reports made by our visiting United States Senators of the serious condition of affairs in Cuba must necessarily enlist the sympathy of all who desire to alleviate the sufferings of the famine-stricken inhabitants. We are advised that Mr. Stephen E. Barton, chairman, 401 Temple Court, of this city, will receive contributions and give information respecting the matter.

RAOUL PICTET in 1895 exposed himself, excepting his head, to a very low temperature in a refrigerator. There was no sensation as of chill from cold, but a tickling sensation was felt both on the exterior and interior of the body. There was also a marked feeling of hunger. He says that for the first time in six years he was really able to enjoy food.

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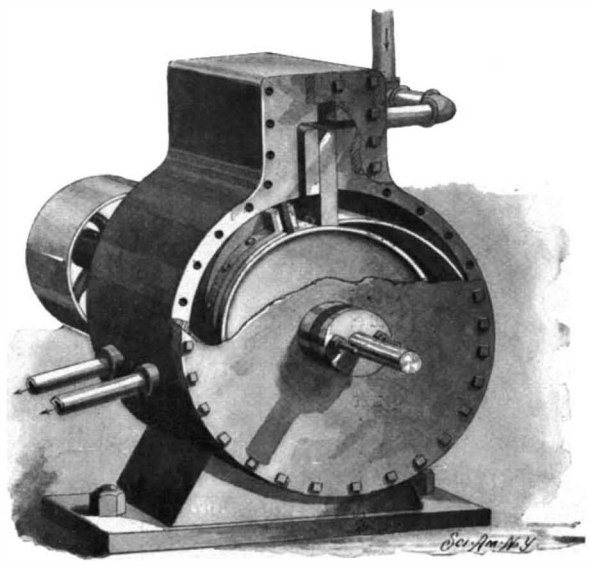
AN IMPROVED ROTARY ENGINE.

The engine shown in the illustration is designed to work with a minimum of friction, has but few parts, and is not liable to get out of order. It has been patented by Gutie H. Tuttle, of Montgomery, Ala., and William W. Buford, of Donaldsonville, La. The engine comprises two cylinders in one casing, the cylinders being separated by a central web, and the shaft carrying two wheels or disks, each occupying one of the cylinders. To opposite sides of each wheel or disk are attached two abutments, each having in its face a packing strip to make steam-tight contact with the periphery of the cylinder, and each abutment has on

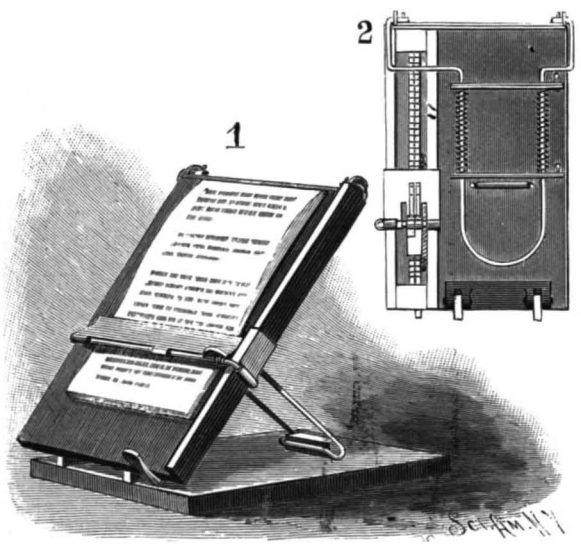


TUTTLE AND BUFORD'S ROTARY ENGINE.

one side a cam or incline adapted to engage and move a sliding abutment or plate, the opposite end of which has movement across the supply port. One end of a flat spring is secured to the lower end of the sliding abutment by means of dovetail tongues, the spring being adapted to lie in a recess in the periphery of the cylinder, and its opposite end being secured in position by screws. The spring extends from the sliding abutment in a direction opposite the direction of rotation of the wheel or disk on the shaft, the cam or incline on the wheel pressing the spring into the recess as the abutment or sliding plate is moved across the supply port, and the spring moving the sliding plate down to admit steam behind the piston head as soon as the latter has passed. The steam pipe delivering steam to the engine is forked into two branches, so as to deliver steam to each side of the engine. The exhaust port is placed at an angle of about ninety degrees from the steam port, and the two piston heads of each wheel being attached at an angle of about ninety degrees on opposite sides, alternate with each other to bring one of the piston heads into use at all times. The spring plate is so proportioned that the pressure of the movable abutment on the wheel will be very slight, thus avoiding undue friction.

A MANUSCRIPT HOLDER AND SPACER.

A device more especially designed for the use of typewriters, to securely hold the manuscript in place and permit of readily turning its pages, while properly indicating the lines of writing as the copying proceeds, is shown in the accompanying illustration, and has been patented by Albert N. Woodruff, of the United States



WOODRUFF'S MANUSCRIPT HOLDER.

Engineer Corps, Willets Point, New York Harbor. Fig. 1 represents the device in use, Fig. 2 being a back plan view partly in section. The manuscript support is hinged at its lower end to a suitable base, and is held in inclined position by a brace, which may be disconnected to fold the support down upon the base. The manuscript is held at its upper end by a clamping bar extending along the top edge of the support, this bar being hung in the ends of a frame which slides in bearings on the back of the support, the frame being pressed on by springs to hold the clamping bar down on manuscript or a book. The lower end of the frame has a handle, by taking hold of which the clamping bar is lifted to permit the removal of the book or manuscript, or, when a page of manuscript has been copied, it may be swung to the rear over the clamping bar. The spacing or line plate is mounted on a rod secured to a slide movable in a guideway at one side of the manuscript support, a spring pressing on the plate to hold it in firm contact with the outer page of the manuscript. The slide extends to the rear of the support, where it carries spring-pressed pawls in mesh with two rack bars, one fixed to the back of the support, while the other slides in bearings, and has at its lower end a finger piece projecting to the front lower edge of the table. By pressing upon this finger piece, when the device is in use, the sliding rear rack bar with its pawl is carried downward, together with the slide and the spacing or line plate, the entire downward movement being the distance between two lines on the manuscript or copy. It only requires a slight pressure on the finger piece to enable the operator to shift the spacing plate as desired.

THE AVEN ARMAND, LOZERE, FRANCE.

BY HORACE C. HOVEY.

In southern France is a region, once an unbroken plain, but now cut by erosion into a number of dry, barren, treeless uplands by deep and picturesque canyons. This is known as the Land of the Causses, a word derived from the Latin calx, through the Provençal caous. These independent plateaus rise to a height of from 1,000 to 4,000 feet above the level of the sea, and the gorges between them are correspondingly deep. There are few running streams along their surfaces; but the rainfall is swallowed by "avens," or pits, like the sink holes of Kentucky, to reappear in gushing springs, that are gathered into rivers clear as crystal, whose cliffs tower to a tremendous height, and display as rich a variety of colors as may be seen in the Grand Canyon of the Colorado.

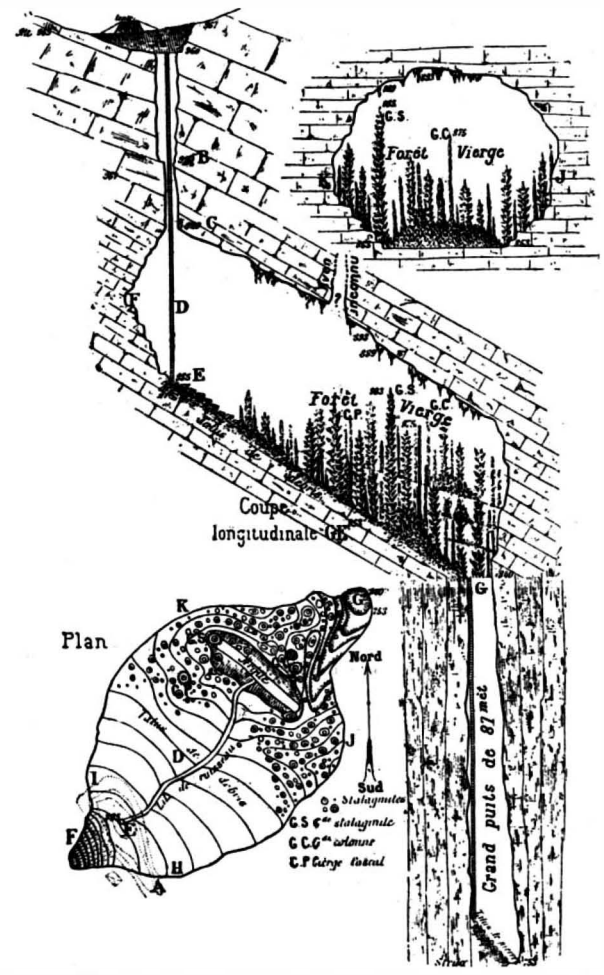
Last September, in company with a party of cave hunters, we went by rail to the quaint old city of Mende, where we took carriages across the Causse, Sauve-Terre, by a magnificent road built at the expense of the province of Lozére. The descent to the hamlet of St. Enimie was by a zigzag series of terraces, leading down from the lofty plateau to the banks of the turbulent river Tarn. Here our party took canoes manned by expert boatmen, shooting some of the rapids, and making portages around others, with occasional pauses to examine venerable castles or interesting grottoes, till, after an exciting voyage of about forty miles, we came to the junction of the Tarn and the Jonté, and made our headquarters at the lovely village of Rozier, whence we made various excursions, only one of which is now to be described, namely, that to the Aven Armand, a singular and terrible pit in the Causse Méjean.

Only four of our party undertook this somewhat perilous exploration, namely, Messrs. Martel, Viré, Armand and myself. We ascended the charming valley of the Jonté to a point almost opposite the celebrated cavern of Dargilan, where we left the state road for a rough and narrow wagon track that wound tediously up the lofty plateau. In doing this we passed many objects of interest. There were tall cliffs, from 500 to 1,000 feet in height, huge monoliths standing like so many obelisks, and majestic archways carved from the purple or vermilion limestone. We saw a number of inhabited cliff dwellings; and saw one that was altogether new, located on the edge of a precipice as abrupt and underneath a crag as inaccessible as those of the similar cliff dwellings of Arizona, but with a winding sheep path leading down to it through a chasm. Geologically speaking, the lower cliffs are of dolomite, above which is a sloping talus of oolitic marl, then another thick mass of Bajocian dolomite, surmounted by thin layers of Oxford limestone, rising like rude stairways to the plateau, where lie broad sheep pastures, with here and there bits of arable land. The only inhabitants are simple peasants, dwelling in moss-grown stone huts, winning a scanty living from their flocks and oat fields.

On the farm of Mr. Bertrand lies an ancient burying ground, the scattered tombs being huge heaps of limestone slabs. One of them we opened, finding human bones and prehistoric implements. In the distance gleamed the Cevennes Mountains, already white with snow, although it was only the 20th of September. Amid the rude dolmens yawned the blackest, ugliest pit that ever entrapped stray animals or unlucky human beings, or that ever tempted reckless cave hunters to fathom its awful depths.

Mr. E. A. Martel, the renowned speleologist, was our leader, and his outfit was complete. It included an ample tent, numerous rope ladders of the most approved pattern and of extra lengths, a folding canvas boat for sailing on subterranean waters, should any be found, a coil of copper wire for our telephone, tools of all kinds needed, together with a fair supply of provisions. No wonder that the peasants took it for the outfit of a traveling circus.

The first thing done was to pitch our tent near the brink of the aven. The next was to gather a quantity of the wild boxwood that grew amid the dolmens, and make a fire by which to warm ourselves and cook our dinner. Preparations followed for descending the aven. Four stout crowbars were fixed firmly in the

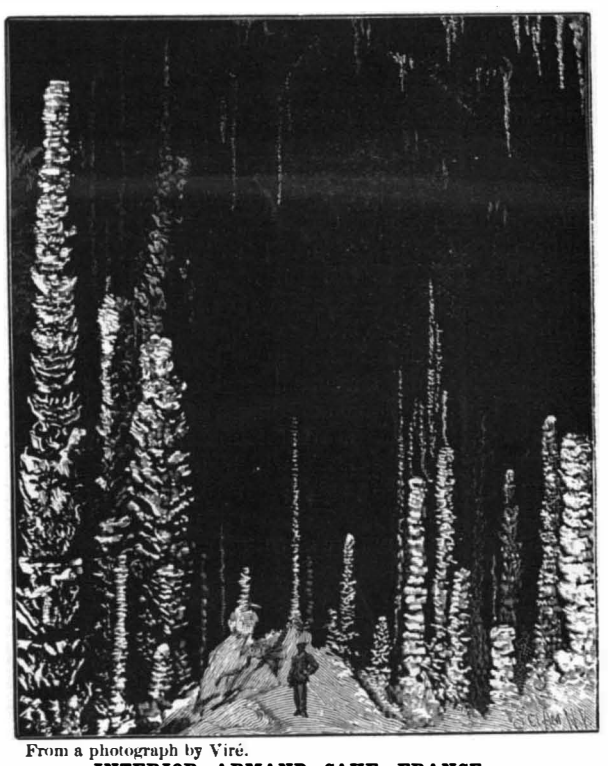


G, C, large column; G, S, large stalagmite; G, P, altar candle; E, bed of cave brook.

THE ARMAND CAVE.

seams of the limestone ledges. The pit was measured and found to be exactly 240 feet in vertical depth. A rope ladder of the required length was fastened to the bars and then hurled down the pit. The copper telephone wire was uncoiled and stretched back from the aven ready for use. It was decided that Mr. Louis Armand was to have the honor of making the first descent, having been the man to call attention to the locality; and it was afterward agreed to give the aven his name, calling it the "Aven Armand," and we are informed that he has since bought the place, with the intention of making it accessible to the traveling public.

Before setting his foot on the first round of the swaying ladder, Mr. Armand fastened a rope around his waist, the end being held by stout peasants. Another rope, held in a similar manner, was attached to a cross bar, on which the explorer sat. These precautions



From a photograph by Viré.

INTERIOR ARMAND CAVE, FRANCE.

were deemed necessary in case some one rope should be cut on the edge of a projecting rock or for some other reason give way. Armand took along a supply of candles and of magnesium ribbon. He carried a pocket telephone, such as is used in the French army, the other end of it being left in the tent. For some time his orders were shouted back long after he had disappeared from sight. But at length his sole reliance was the telephone. It seemed an age before the news was whispered up from the heart of the earth that he had

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landed safely amid a forest of stalagmites at the bottom of the shaft and was going to explore his surroundings. After a considerable interval of silence, he telephoned that a sloping way led down to the edge of a second pit deeper than the first, the depth of which was found on measurement to be 300 feet. Then, at Mr. Martel's request, Armand climbed to the surface to make a fuller report than could easily be made over the wire. The excitement of our party was intense. Adding the measurements together, which were afterward verified, we found that the total depth of this enormous abyss was 210 meters, or about 680 feet. Only one cave deeper than this is known in France, and it is one of the most profound caverns in the whole world.

One after another our party climbed down that slender rope ladder, and surveyed the wonders never before seen by mortals. We took several flashlight photographs, only one of them, taken by Mr. Viré, proving very good. It represents what is called "The Virgin Forest," of mighty palmlike stalagmites rising to the lofty height of from 50 to 90 feet, and untouched as yet by the tool of the geologist or dimmed by the explorer's torch.

As the leader of our party, Mr. Martel enjoyed the right to make the official report of this famous discovery, which he did before the French Academy of Sciences, accompanying it by maps and diagrams. Observation of environment suggests that this aven was once the drainageway for an ancient lake, whose contour we were able to trace over the plateau. The excavation, like that of all other limestone caves, was by means of the chemical and mechanical action of running water, although now it is dry, as far as explored, the water having disappeared from numerous fissures below, except as a narrow rivulet winds along the floor of the cave, fed by rains. Henceforth, in counting the wonders of the world, mention must be made of the Aven Armand of the Causse Méjean.

COLUMBIA'S ARTIFICIAL MOON.

Two weeks ago we published an article on the new buildings of Columbia University, and as at that time announced, we publish herewith an account of the system of lighting by reflection as used, we believe for the first time, in the great dome of the library building.

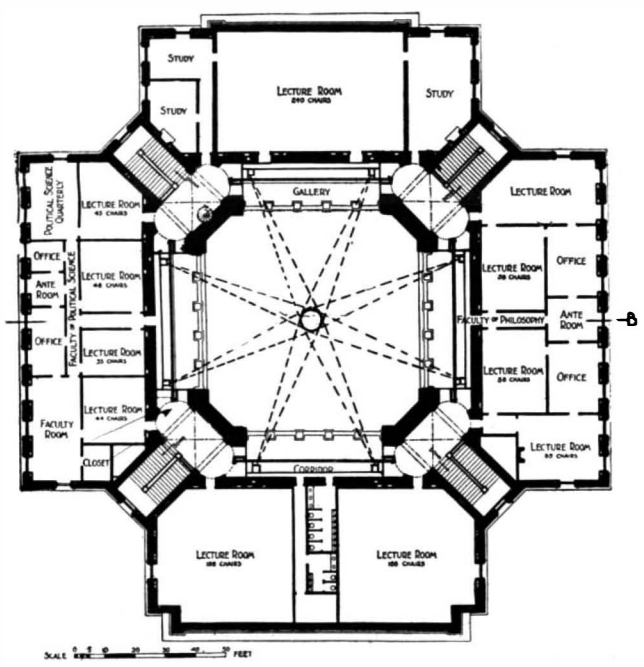
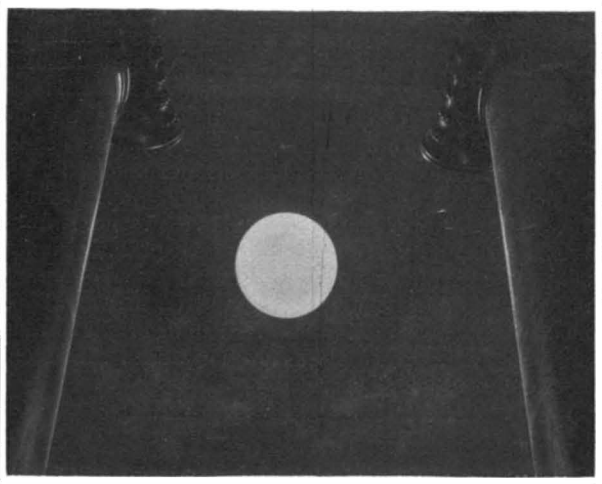


Fig. 1.—SECTION THROUGH GALLERIES IN WHICH PROJECTION LANTERNS ARE LOCATED.

In the design of the new memorial library, donated by President Low to Columbia University, of this city, several illumination problems presented themselves which were difficult of solution and demanded an exercise of considerable originality. It had been decided to light the reading desks in the manner employed at the old library, i. e., by 16 candle power incandescent electric lamps on stands, placed about two feet above the tables and provided with conical shades, green outside and white inside, to direct the light downward. A few lamps were also to be placed behind the columns and on the walls for general illumination below, but no method for lighting up the vast dome, the massive carved stone arches and the architectural features, statuary and books of the upper balcony; these would be left at night in darkness. Again, a bright light source, such as a chandelier, a cluster of arc lamps or even distributed sources of light, would be difficult to get at, cast shadows that would be too dark, dazzle the eye, and destroy the softness in architectural effect striven for. This is the problem that presented itself to Mr. McKim, the architect, and he hit upon the plan of employing a large, luminous light source that would give a steady, pleasant light and one that would produce no sharp shadows. With this idea he went to Prof. Hallock, of the University, and requested that a method be devised to carry out his plans. Experiments were begun, and it was determined to suspend a huge white sphere from the center of the dome and to project upon it the rays of some intense light, such as that from an electric arc. It is well known that a dead white surface will give out 70 to 80 per cent of the light projected normally upon it and that, when the surface has a matt finish, the light will be diffused and lose the glare which accompanies light coming from a polished surface, all of which was as desired. The sphere was built in the summer of 1897, tried once in December, and at the present time is to be seen every Friday evening between the hours of 5 and 7, for the life of the carbons is but 2·5 hours. The large reading room is not used at night, smaller rooms being available, and the "moon" shines but for the accommodation of visitors at the present time. It is as yet in somewhat of an experimental stage of development, but will later on be used regularly.



THE MOON AS IT APPEARS FROM THE MAIN FLOOR OF THE LIBRARY.

General Arrangement.—As will be seen in Figs. 1 and 2, the library is built of cut stone, shown black in section, the external dome being of cut stone and brick. To prevent spreading, there is walled into this dome two steel circular bands, placed at about the height of the top of narrow passage inside the arch. No scaffolding was used in building this arch, but the voussoir stones kept it in place, one layer being finished before the next was added. Inside this stone dome is another dome made of steel and plaster, painted on its interior a dark blue. This color was intended to imitate the deep blue of the clear sky, and consisted of Prussian blue mixed with whiting, the latter being necessary to produce a dead surface without reflecting properties.

Toward the horizon of this sky the tint becomes less dark and shades off so gradually into the still lighter cornice that the effect is more natural than striking. At the level of the lower edge of this dome the sphere or "moon" is placed, receiving the rays of light projection lanterns equally spaced, as shown, and overlapping slightly on the bottom of the sphere. The color of the stonework is a light gray, the columns are a very dark green, with gold capitals, while all woodwork is of oak.

In the semicircular windows the glass is clear translucent and affords sufficient light during the daytime for reading, the electric lights being turned on when it fails on foggy days or toward evening to one-half foot candle. In the galleries behind the columns are hung three 10-inch frosted globes on each side, 12 in all, each containing one 16 candle power lamp—in fact, there are none but 3·5 watt 16 candle power incandescent lamps used in the library. These lamps are not shown in Fig. 2, neither are the book shelves between the columns, nor the 44 lamps they carry, each having a 6-inch spherical frosted globe. The central circular reference shelves also carry 16 such lamps inside and out. Upon the reading desks are placed 152 lamps with conical shades, making a total of 224 16 candle power lamps. But 64 of these are intended for general illumination, and, as they lose about 50 per cent of their light upon passing through ground glass, 32 bare lamps would give the same illumination. Each reading lamp is turned on separately, so that at no time are they all burning, unless all the chairs are occupied at one time. When the lamps are lit, the least illumination received by a page placed horizontally upon the table is about 1·5 foot candles, so that the lighting below may be considered satisfactory. It is, however, the lighting of the upper part of the general reading room with which we are at present concerned.

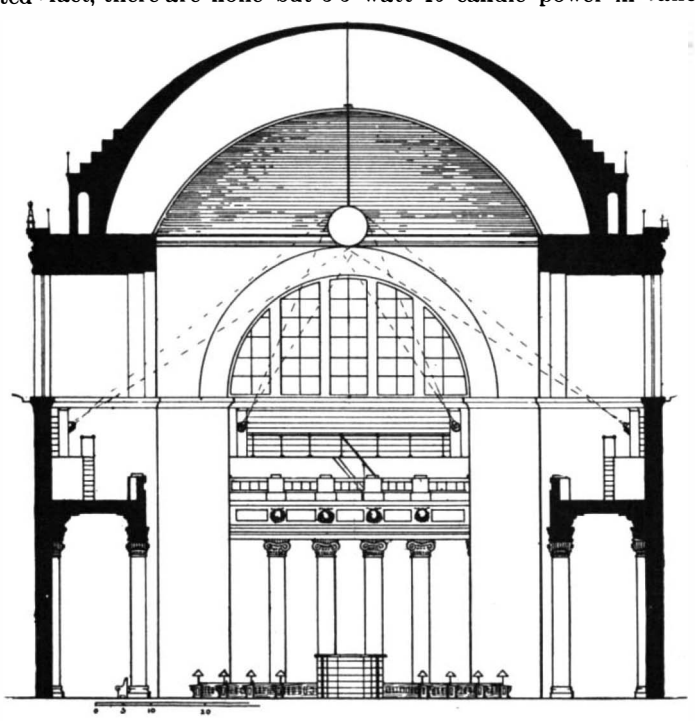


Fig. 2.—SECTION OF LIBRARY SHOWING LOCATION OF MOON AND PROJECTION LANTERNS.

Construction Details.—The "moon" is 7 feet in diameter, having a framework of wood arranged in meridians and parallels. Upon this frame is fastened wood veneering in such a manner as to give a smooth surface to the sphere. It is made in two halves, divided at what corresponds to its equator, and covered by a coat of kalsomine. A quarter inch wire rope suspends this ball, running through its north pole to an iron plate covering externally its south pole, thus making a very secure fastening. This wire rope runs through the dome and over a winch outside, where it is held in place by both a ratchet and grip. If both of these should fail, the ball would be stopped by the rope being not quite long enough to reach the floor. This ball weighs probably 400 to 500 pounds and is seen against a blue background from all parts of the library. The projectors are what is known as the Colt & Company automatic feed type of arc light, the carbons being fed in both directions, so that the arc is always in the center line of the condensing lens. This construction is plainly shown in Fig. 3, along with that of the lenses and the direction of the projected light; the design may be changed, however, as it is not all that could be desired. The objective is so adjusted that the circle of light thrown upon the sphere does not come within about 3 inches of the edge; otherwise, it would form a crescent upon the dome. The carbons are $\frac{7}{16}$ of an inch in diameter, last 2·5 hours, have an arc resistance of 45 volts and an outside current, obtained by resistance boxes, of 125 volts (or 50 volts, if desired). It is supposed that 18 ohms of current are consumed per arc, although this evidently varies, as 25 and 30 ampere fuses have frequently been burned out. No tests of current have yet been made. The position of the arc can be adjusted, as can also that of the projected disk of light. The top carbon is placed slightly to the rear of the lower carbon, causing a crater to form upon the side of the former from which the rays go directly where they are the most needed. This crater is said to emit 80 per cent of the light of the arc, is elliptical in shape, ¼ inch wide by ⅛ inch across, and has an area of about 0·1 square inch. Both the body of the projector tube and the objective tube slide in and out, by which means the circle of light is properly focused, although this focus should not be sharp, as the overlapping rings of light thus become too apparent, and the globe assumes a pieced-up appearance. The projectors are placed in closed blackened closets.

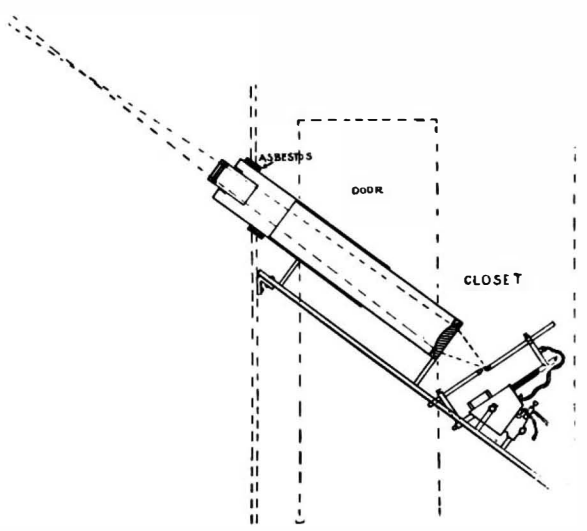


Fig. 3.—SECTION OF PROJECTION APPARATUS.

Operation.—Just before lighting, the several arc lamps are tried separately to see whether they are directed properly and feed well. Then they are turned on and give a light which varies in intensity with the feeding of the carbons. As the circles overlap in some places threefold and in others have but one arc to cover them, and as these arcs may vary from 500 to 5,000 candles, it is very evident that there will be slices of the

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globe which are decidedly darker than neighboring patches. When the lamps burn regularly, however, the intensity is pretty uniform and the brightness of the globe is more uniform. No doubt this feature will be improved upon. As the projection lanterns are easily accessible, there is no trouble in preparing for the next day's illumination, or in adjusting, cleaning or repairing the apparatus.

Photometric Tests.—A series of tests were made with an illumination photometer, which indicated that the

Illumination of horizontal surface	on balcony	= 0·034	foot candle.
" " " "	of reading tables	= 0·012	" "
" " perpendicular "	" " "	= 0·013	" "
" " " "	on balcony	= 0·085	" "

The arc was 6 inches away from the condensing lens, which in turn was 71 feet from the sphere surface; the latter was 60 feet from the balcony and 80 feet from the reading tables. The illumination of 0·085 of a normal ray was observed when the candle was 41 inches distant. This would give us

$$\frac{(60 \times 12)^2}{41^2} = .300 = \text{candle power of sphere.}$$

As about 20 per cent of the rays are absorbed by the white surface and 20 more lost by reason of the angle of reflection, 300 ÷ 0·6 = 500 candles will be received by the globe. It is safe to assume that the candle power at the point at which the rays cross is equal to that of the arc's useful intensity. This crossing takes place 66 feet from the sphere; then

$$\frac{(60 + 66)^2}{66^2} \times 500 = 2{,}200 = \text{candle power of the arc.}$$

This value is probably somewhat low and indicates that there are other considerable losses. If we assume that 16 amperes are consumed by each arc, we find by the following formula (i referring to amperes)

$$I = 190\ i + 3{\cdot}8\ i^2 = 3{,}972 \text{ candles.}$$

Such high candle powers are rare, and with a ⅜ inch carbon unusual. The actual candle power is probably not over 3,000. The candle power of the under side of the globe, reckoning from the tests made upon the floor, was found to be 76, indicating a large loss when the light strikes such a surface as that of the sphere at an acute angle. When the photometer box was placed horizontally in the balcony the illumination was found to be 0·034 foot candle; when normal to the light ray it was 0·085, or a decrease of 40 per cent for an angle of incidence of 56°. This was afterward verified by experiment, showing that the reflection angle is an important factor in lighting any given locality.

Although this illumination is not equal to that of a full moon in all her effulgence at the zenith, yet it is sufficient to read by, although not for a great length of time. Under the best conditions the illumination of the reading desks may attain, by the sphere alone, to 0·02 foot candle, or equal to that of the normal rays of a candle 8 feet 6 inches away. With the assistance of the 12 hall lamps, 5 of which were at the time visible at the photometer box, the illumination rose to 0·03 foot candle.

It is generally considered that one foot candle is sufficient for reading or study and that 0·75 foot candle is not fatiguing; also that 0·40 to 0·60 foot candle makes a satisfactory general illumination, although the mean illumination of an average small room, such as is found in hotels, by a single 16 candle power incandescent lamp is between 0·30 and 0·40 foot candle, and this must answer the purpose of both general and reading lighting. It is therefore evident that the illumination furnished by the globe is small at any part of the library, varying as it does from 0·01 to 0·09 foot candle, but it is surprising, nevertheless, how sufficient it is. The large globe of light has a brilliant, clear, opalescent tint and is a pleasant object to contemplate against its dark background. The light is without sharp shadows; although slight shadows are cast, the edges have a diffused appearance; and when all other lamps are turned off a distinct moonlight effect is produced which has led this sphere to be named the "moon."

Cost of Lighting.—Taking the cost of an arc lamp at one cent per ampere hour, 8 arcs of 16 amperes each will cost $1.28 per hour or $3.10 for a run of 2·5 hours. Incandescent lamps cost an average under all conditions of about 0·5 cent per hour. As there are 224 of these lamps, they will cost when all are in operation $1.12 per hour, a total of $2.40 per hour. Of these 224 lamps but 64 are employed in illumination, at a cost of 32 cents per hour, making the cost for general illumination $1.60 per hour. The University has its own generating plant and uses electricity throughout all its buildings.

Adaptability and Advantages.—This system of lighting is of wide application and can utilize many different light sources. Instead of the electric arc, other intense lights, such as that obtained from acetylene or an incandescent mantle or bulb, may be used separately or in clusters by means of reflectors and lenses arranged to project the rays upon a variety of surfaces of varying character, color or extent. There is no limit to the novel effects that could be produced, and the luminous surface could be placed in all sorts of inaccessible places, its color varied by screens to match the color of decorations or even to set off to advantage a favorite dress of my lady. For theaters it is especially adapted. For halls and places where many people congregate it has superior advantages, for here the light sources can be placed outside the room and the rays projected into it, thus avoiding the heat, glare and vitiation of air in the room itself, inconveniences which are now too common. Physiologically, a glaring light is destructive to eyesight sooner or later, but a diffused light, even when very dim or bright, so nearly resembles the character of the daylight our eyes are so accustomed to that the effects are not abnormal. It is quite a frequent sight during the past year or two to see the light directed into the ceiling by opal shades, there to be diffused, and the effect is always very pleasing and easy on the eyes. Notwithstanding the well known and oft-experienced evil effects of an intense light placed in the field of vision, we see it in churches, most public rooms, theaters, railway cars, everywhere, in fact, where public lighting is employed. Occasionally some philanthropist, as in the case under discussion, considers the comfort and well-being of his fellow man and does away, by a master stroke, with the glare of unshaded light sources and puts in its place a glow of soft radiance that must be seen but to be appreciated.

Electrical News and Notes.

In Turkey the use of electricity is prohibited by an irade of the Sultan, and in accordance therewith, patents for electrical inventions are refused.

Klondike Electric Road.—The electrically operated cable road over the Chilkoot Pass, driven by Westinghouse motors, is reported open, says The Electrical World, with a capacity of handling 150 tons of freight daily.

Dr. Herz Wants an Indemnity.—Dr. Herz of electrical fame has presented a claim for indemnity in the sum of $5,000,000 against the French government for an alleged attempt to persecute Dr. Herz. The claim has been filed in the United States State Department, as Dr. Herz is an American citizen.

Electric Lines for Freight.—Several street railway companies of Massachusetts have petitioned the street railway committee for permission to do an express business, and some have included freight in their request, says The Railway Review. One petition requests permission to carry goods in packages to the weight of 100 pounds each, and an officer of the road making this petition says the intention is to stop cars at houses by the roadside to load and unload such parcels.

Establishing Communication Between Fortifications.—General A. W. Greely, chief signal officer of the army, spent several days recently in New York, Boston and other Eastern cities on work connected with establishing communication between fortifications, says The Electrical Review. In New York General Greely had a conference with Captain James Allen, of the Signal Corps. Captain Allen, by order of General Merritt, recently laid out a plan for connecting all the fortifications in New York Harbor by telegraph. It includes the laying of a cable from Governor's Island to Sandy Hook, and connecting cables to Forts Hamilton and Wadsworth. Land wires are to connect Forts Schuyler and Slocum and Willets Point with one another and with Governor's Island. The cost of this work has been estimated at $50,000.

Mirrors for Search Lights.—The strength of the Spanish navy in torpedo boats makes it necessary that all United States vessels and forts shall be provided with search lights, and it is found that it is no easy matter to purchase a sufficient number of search lights in an emergency. A large number of the finest search light mirrors have been bought, but an adequate supply of them cannot be had. Having mirrors, the electric companies could turn out the lights in a brief time. The mirror is an essential part of the light, and its manufacture is a delicate operation which needs care and time to finish it successfully. It is not an ordinary reflector which may be cast and moulded, but has to be ground accurately and highly polished. It is really a concave lens, backed by silver and hardened vulcanite. Machines for grinding the reflectors have been made which facilitate the work, but it requires about a week to make a satisfactory mirror. The glass is purchased, moulded into shape, and the machines are put to work on this and the surfaces are ground to the requisite curve. After grinding and polishing the mirror is tested, and when it is satisfactory the silver back is put on by electrolysis and this back is covered by an opaque substance, generally vulcanite. Search light mirrors were first made in England about 1881; later Germany and France took up their manufacture, and the best mirrors are to-day made in the last two countries. Entirely satisfactory mirrors are made in this country. At present there are a few of the fortifications equipped with search lights, and at nearly every coast fort a dynamo would have to be set up to supply the light. It is stated that should an emergency demand it, every fortification could be supplied with a searchlight and a dynamo within four months.

Science Notes.

The Prince of Monaco continues his researches on the fauna of the Mediterranean and the Atlantic at great depths. Near the Azores he has discovered a volcanic bank fifty miles long, and a Portuguese captain has discovered a second bank close by. These banks are the resort of numberless fishes. The prince is having a new vessel of 1,400 tons built for further explorations.

The Russian government has decided to introduce the French metric system of weights and measures throughout the Muscovite empire, and, by order of the Czar, a decree to this effect has been submitted to him for signature. An imperial commission has likewise been organized at St. Petersburg for the purpose of considering the best means of abandoning the Russian calendar in favor of that which prevails in the remainder of the civilized world.

This year's crop of centennial celebrations includes observations of the four hundredth anniversaries of Vasco de Gama's discovery of the way to India by way of the Cape of Good Hope, at Lisbon in May; of the burning of Savonarola at Florence, also in May; and of the birth of Holbein at Basle, in Switzerland. Montpellier will celebrate the hundredth birthday of the philosopher Auguste Comte; Ancona that of the poet Leopardi, who was born at Recanati, close by; and Paris that of Michelet, the historian.

Foreign postal transmission is surprisingly rapid nowadays, says Engineering News. A letter sent to Vienna from an office in New York City was dispatched by the steamer sailing at 10 A. M. on Wednesday, January 5, and a cablegram reply was received at 10:45 Thursday, January 13. The route of the letter, with distances, was as follows: New York to Southampton, 3,050 miles; by rail to London, 80 miles; by rail and Channel steamer to Paris, 238 miles; by rail, Paris to Vienna, 735 miles—a total of 4,203 miles.

Mme. Chossegros, who lived at 1 Rue Bourdaloue, Paris, has just died, at the age of sixty-two. Ever since 1869 she had been a prominent member of the Society for the Protection of Animals, and by her will the society is a gainer by about 2,000,000 francs, the property being principally represented by jewels and other personal property. At present the capital of the society is 500,000 francs, which brings an income of 17,000 francs. The bequest would increase this fourfold, but, according to the terms of the will, of which the society is sole legatee, the funds are to be employed to establish new posts of inspection in the outlying districts of Paris, where horses will be treated free of charge, and also for better accommodations in the society's large veterinary hospital in the city. Mme. Chossegros did a great deal toward spreading the ideas of animal protection throughout the provinces, and was instrumental in establishing branches of the society in Lyons, Marseilles, Bordeaux and Lille.

Dr. W. S. Colman describes a number of cases of "color hearing," such as are well known to psychologists, in which a sensation of color associates itself with certain sounds, the color seen being definite and invariable for the same sound. In one class of cases a crude color sensation, often very beautiful, is associated with each of the vowel sounds, musical notes or particular musical instruments, the appearance being usually that of a transparent colored film, similar to a rainbow, in front of the observer, but not obscuring objects. In a second class there are color sensations whenever letters or written words (symbols of sound) are spoken or thought of, so that when a word is uttered the subject visualizes the letters, each having a distinctive tint. Dr. Colman is of opinion that the phenomena are "associated sensations," analogous to the cutaneous sensation of shivering in certain parts of the body, which varies in different individuals. The tints excited are very definite and characteristic, each for its own sound, and they do not vary as time goes on. The colors are scarcely ever the same in two individuals.—Lancet.

An ingenious method of fixing iridescent films has been devised by C. Henry, Director of the Physiological Laboratory at the Sorbonne. A sheet of impermeable paper or other material is placed at the bottom of a rectangular vessel furnished with a tap which allows it to be completely emptied. The vessel is filled with water, and a few drops of a solution of a resin, bitumen or tarry body, dissolved in a volatile medium, is dropped on the surface of the water; as the solvent volatilizes it leaves a pellicle which is beautifully iridescent. If a whistle or other musical instrument be blown above the surface of this film, the colors will be observed to change with the vibrations of the particular tone produced. When evaporation has proceeded far enough, the tap is opened and the water allowed to run out slowly. In this way the pellicle is fixed to the surface of the paper, which, when dried, reproduces the iridescence in a very striking manner. A very fine specimen of paper so prepared, which accompanies the note, in appearance resembles watered silk, or the glossy iridescence which is seen on the feathers of certain birds or scales of insects.—Répertoire [3], ix., 493.

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THE "NEW ORLEANS."

On our front page will be found a spirited drawing, made from a photograph, of the "New Orleans," the new cruiser recently built at the Armstrongs, England, and purchased by the United States government from Brazil. The "New Orleans," as we pointed out at considerable length in our issue of March 26, is one of the finest representatives afloat of what is known as the protected cruiser class of warships. Vessels of this type are distinguished by great speed, a large coal-carrying capacity, enabling them to cover long distances without having to run into coaling stations, and by the comparatively light armor with which they are protected. They are entirely devoid of vertical side armor, protection against the entrance of shells into the vital parts of the ship being assured by a continuous deck of steel, which curves downward toward the bow and stern, and also toward the sides of the vessel, where it meets the side plating several feet below the water line. The space between the curved sides of the deck and the vertical plating of the ship is occupied by the coal bunkers, which are arranged along the side of the ship in the wake of the engines and boilers. The inclined steel deck in the case of the "New Orleans" is three inches in thickness, and this combined with six or eight feet of coal would serve to keep out all except the heavy rapid-fire shells of the enemy. A ship of this type never carries what are known as armor-piercing guns. She has no place in the line of battle, where she would be in danger of being sunk by a single shot from the big guns. The duty of the protected cruiser is to serve as the outlook, or eyes, of the fleet, keeping touch with the enemy and hurrying back to the main squadron as soon as she gets sight of the enemy.

The protected cruiser is supposed only to engage ships of her class or armed merchantmen which have been equipped with guns in the way in which it is intended to fit out the "St. Louis" and the "St. Paul." She must be swift enough to run away from the battleship, and swift enough to overtake and bring to an engagement vessels of her own class. Hence an up-to-date protected cruiser of the first class seldom has less than 20 knots speed.

The main dimensions, etc., of the "New Orleans" are as follows: Length, 330 feet; beam, 43 feet 9 inches; draught, 16 feet 10 inches; displacement, 3,600 tons. She is driven by twin engines of 7,500 horse power at a speed of 20 knots under natural draught. Under forced draught she attained a maximum speed of 21·05 knots per hour.

The armament is very powerful for the size of the ship. It consists of six 6-inch, four 4·7-inch and ten 2·24-inch rapid-fire guns, besides four 1-pounder Nordenfelts, four Maxims and two field guns for landing operations. Three above-water torpedo tubes are fitted, of which one fires right ahead, and one on each broadside. A very heavy fore and aft fire can be obtained, as two of the 6 inch guns are in shields on the poop and forecastle, and the other four are sponsoned well out, two forward and two aft. The 4·7-inch guns are carried in recessed ports, so as to be clear of the fire of the larger pieces. The ammunition is supplied through hoists worked by electric motors, and seven rounds a gun can be fired each minute. Four electric searchlights are fitted, one on a platform on each mast, and the others on deck. The ship is, of course, electrically lighted throughout.

An excellent feature of this vessel is that she is sheathed with wood below the water line and coppered. This will enable her to remain afloat for a great length of time without entering dry dock to be cleaned. The military masts are a conspicuous feature of the ship on account of their size and the double tops which they carry. In these tops will be located the deadly Maxims and Nordenfelts, whose duty it will be to repel torpedo attack and sweep the decks and exposed gun positions of the enemy.

The transfer of the ship took place at Gravesend, at the mouth of the Thames, England, when the ship was formally handed over by Commander Corres, of the Brazilian navy, to Lieut. Colwell, of the United States navy. The Brazilian flag was hauled down and the stars and stripes were run up, accompanied by a salute from the old fort at Tilbury, whose guns had not spoken for two centuries past. By the time this issue is in the hands of our readers the "New Orleans" will probably be in an American port.

THE LAUNCH OF THE UNITED STATES BATTLESHIPS "KENTUCKY" AND "KEARSARGE."

March 24, 1898, will always be a red-letter day in the annals of the United States navy, as having witnessed the launch of two of the most powerful ships of its first line of battle. The "Kearsarge" was released from the ways at 10:02 o'clock in the morning, and as the great ship began to move slowly down the ways, Mrs. Herbert Winslow threw the time-honored bottle of champagne against the bow, at the same time saying, "I christen thee 'Kearsarge.'"

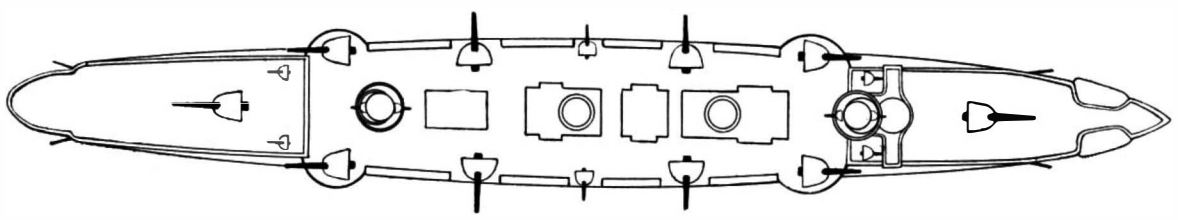
An hour and a half later, Miss Christine Bradley, on behalf of the Blue-grass State, whose name the ship will carry, flung a cut-glass bottle of water against the sister ship and gave her the name "Kentucky."

The two ships were built on opposite sides of a powerful traveling construction derrick, on ways specially prepared for them. They will be exactly identical and will form the most powerful pair of battleships in our navy.

The leading features of the two ships are as follows:

Waterline length	368 ft.
Beam	72 " 2½ in.
Draught	23 " 6 "
Freeboard forward	14 " 3 "
" aft	13 " 3 "
Displacement	11,525 tons.
Speed	16 knots.
Coal supply	410 tons.
Horse power	10,000
Armor nickel steel.	
Waterline belt	16½ in.
Side armor above belt	6 "
Turret armor	17 and 15 "
Barbette armor	15 "
Conning tower	10 "
Protective deck	2¾ "
Armament:	
Main battery	4 13-in. guns.
Submain battery	4 8-in. guns.
Secondary battery	14 5 in. R. F. guns.
	20 6-p'nd'r R. F. guns.

If it is compared with the "Indiana," it will be evident that the greatest change in the "Kentucky" is in the novel method adopted for carrying the 8-inch guns. In the "Indiana" there were eight of these disposed in four turrets, at the four corners of the central armored battery. By this arrangement it was hoped to be able to train four guns on either beam or directly ahead. In the gunnery trials, however, it was found that if these guns were fired direct ahead or astern, their blast rendered the sighting hoods of the 13-inch guns untenable. To prevent this "interference," as it is called, double-deck turrets were adopted. They constitute the most striking feature in these ships; nothing like it has ever been attempted before and it is not likely that it ever will be again. As far as the danger of interference is concerned, the device is likely to prove a success. The muzzles of the 8-inch guns project well beyond the sighting-hoods of the 13-inch gun turret below it, and no serious effects will probably be felt by the man stationed within them. It will be noticed, moreover, that the "Kentucky" will be able to bring the same number of 8-inch guns to bear in any direction as the "Indiana," that is, two ahead or astern, and four on either beam; in fact, owing to the inability of the 8-inch guns of the "Indiana" to be fired dead ahead or dead astern, the four 8-inch guns of the "Kentucky" may be said to be more efficient than the eight similar guns of the "Indiana." The great weight of two turrets and four guns with their ammunition is thus saved and can be put to other uses.



DECK PLAN OF THE "NEW ORLEANS."

Next to the turrets the most novel feature in these ships is the powerful broadside battery of fourteen 5-inch rapid-fire guns which it has been possible to substitute for the four 8-inch guns and turrets and the four slow-firing 6-inch guns of the "Indiana." This battery is shown in the engraving ranged within a central battery on the main deck between the two turrets. There are seven guns on each broadside, each gun firing through an arc of 90 degrees. Though the shell for the 5-inch gun weighs only 50 pounds as against 250 pounds for the shell of the 8-inch gun, so great is the rapidity of fire from the former gun, that three times the weight of metal will be thrown in a given time from the rapid-fire battery. The gunners will be protected by 6 inches of Harveyized steel.

On the deck above will be another battery of twelve 6-pounder guns, and eight others will be located forward and aft on the berth deck. It will be the work of these guns to repel the attack of the torpedo boats. A number of 1-pounders and Gatlings will be carried in the tops of the military masts for the purpose of sweeping the decks and other exposed portions of the enemy. It will be seen that the ship floats high out of the water. When her massive turrets, heavy guns and side armor are in place, together with her coal, stores and internal fittings, she will sink some 12 or 15 feet lower in the water.

Our engraving of the "Kentucky" is made from a photograph taken immediately after the launch as the ship was being towed to her berth. Just beyond her stern is seen the armored cruiser "Brooklyn," and in front of the bow of the "Brooklyn" is visible the flag flying from the stern of the monitor "Puritan."

An Electrician's Fatal Mistake.

Nelson W. Perry, a well known electrical engineer, who was formerly editor of our contemporary Electricity, died on March 27 at his home, from the effects of a poisonous liquid taken by mistake for water. The previous night he was experimenting with an incandescent gas burner which he had invented. On the table beside him were two glasses, one containing water and the other a solution of potassium bichromate. It was necessary from time to time to turn down the gas, and in one of the brief intervals of darkness he reached for the drinking water and picked up the wrong glass and swallowed a quantity of poison. He called for assistance and physicians were summoned, but death occurred the next evening. This lamentable accident should serve as a warning to our readers, who very frequently handle poisons, explosives or inflammable chemicals. All chemicals should be preserved in bottles, properly labeled and kept as far away as possible from medicines. In using poisonous chemicals it is always better to use beaker glasses or something which does not resemble the ordinary drinking glass. In working with inflammable chemicals the greatest possible care should be used to have the room well ventilated and have no open light. If possible, experiments requiring inflammable chemicals should be made only during the daytime. This will avoid most of the danger. During the last two or three years the number of accidents which have occurred to scientific men and inventors have been many and serious. Several lives have been lost, so that we do not consider our readers can be cautioned too often regarding the deplorable results of carlessness in experimenting.

Recruits from Cornell.

From a letter to Commodore Melville, Chief of Bureau of Steam Engineering, United States Navy, by Dr. R. H. Thurston, the writer states that there are a number of young men graduating from Cornell who are desirous of entering the navy. He calls attention to the fact that these men have had an exceptionally complete and practically valuable preparation for success in the navy, as they have had for four years a continuous and systematic course of instruction, training and practice in the workshops of the institution and in the laboratories. They have been systematically taught the science and practice of the art of machine designing and they have had considerable experience in its application to the designing of heavy machinery, principally the steam engine. They have in the mechanical laboratory of the department of experimental engineering learned to test all of the materials of engineering, and have conducted engine trials and boiler tests and are familiar with all the special apparatus of the engine, and its use is entirely and perfectly satisfactory in their hands. Dr. Thurston says these young men desire the privilege of giving to the nation their services. What is true of Cornell is probably true of other scientific schools in the United States, and it is gratifying to note there are so many fully equipped young men who desire to sustain the honor and prestige of their country, and the services of these highly educated young men will prove of the greatest possible value, should an emergency arise which would require them to act.

The Current Supplement.

The current SUPPLEMENT, No. 1162, contains several articles of interest. "Some Botanical Curiosities" describes the dragon tree of Teneriffe, from which we get the important resin named "dragon's blood." "The Restoration of Marienburg" describes the rebuilding of an interesting German castle. "The Laboratories of Cornell University" describes the modern laboratories equipped with the latest apparatus for teaching and conducting researches in bacteriology, pathology, histology, embryology, etc. "Tuberculosis and Vinegar" gives important facts as to the bacteriology of vinegar. "Linde's Method of Producing Extreme Cold and Liquefying Air" is a subject of an interesting paper, by Prof. Ewing, describing a novel process for obtaining extremely low temperatures and liquefying air. "Amateur Plaster Casts" describes simple methods of making plaster casts. This is an inexpensive amusement which may be enjoyed by every amateur. "Chinese Government Officials" describes the method of conducting business in the Celestial empire, including their famous civil service examinations. The "Speech of Hon. T. A. Jenckes in Defense of the Patent Office" ably sets forth the merits of our patent system.

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A SIMPLE MIRROR GALVANOMETER.

Mr. James F. Hobart has described in The American Electrician a simple manner of constructing a home-made galvanometer.

The instrument described herewith is intended to obviate almost entirely the necessity for skilled manipulation, upon the principle which pays so well in the machine shop, viz., that the whole be so designed in its several parts that the machine work shall be reduced to a minimum, or even dispensed with altogether, save a little drilling, etc.

The above scheme has been adopted in making the galvanometer, which, after having been turned out "with jack knife and pliers," will give results closely approaching those received from a more elaborate and costly instrument. Fig. 1 gives a view of the instrument complete. It consists of four parts—the lamp, the screen, the lens and the coils and needles.

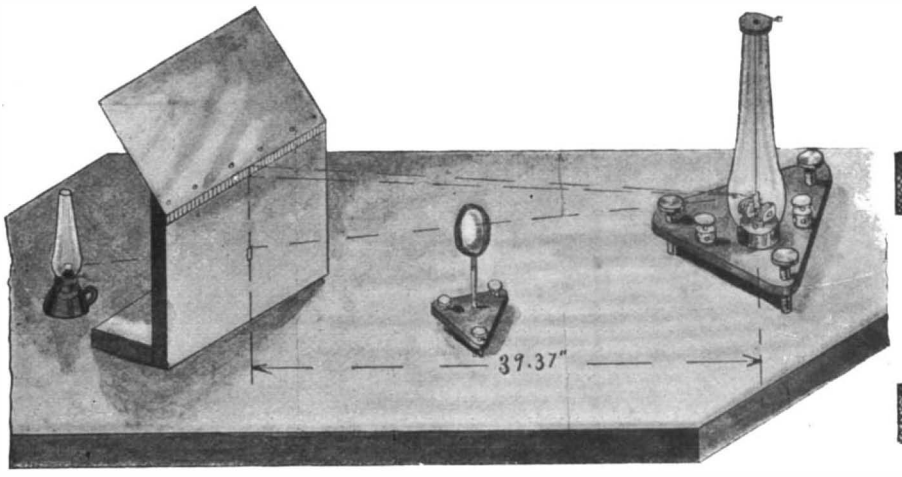


Fig. 1.—SENSITIVE "HOME-MADE" GALVANOMETER

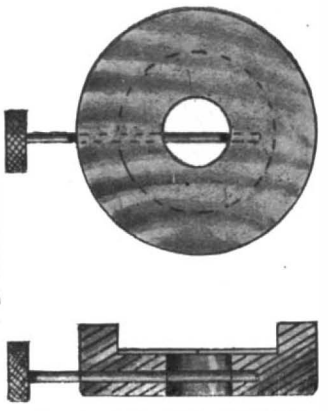


Fig. 3.—CAP FOR TOP OF GLASS CHIMNEY.

For the lamp, a bicycle lamp leaves nothing to be desired, though a common kerosene hand lamp, as shown in the engraving, answers every purpose. The vertical board is as high as the lamp, and the scale is attached to the top edge of the board. The scale may be an ordinary yard stick or ruler fastened to the board, or it may be a strip of paper ruled to millimeters and shellacked to the board.

The tin shade is simply to cut off some of the light which otherwise would be reflected over the top of the scale and dim the bar of light. A clean, sharp slit may be made by cutting a somewhat large hole in the board, and covering it with a bit of cardboard or brass, in which a slit of the size found by experience to be best has been cut.

The lens may be an ordinary reading glass or it may be one of the cheap lenses to be obtained in almost any shop for a few cents. Almost any form of lens can be made to answer, but preferably it should be a double convex, of very long focus—16 inches to 18 inches. If a reading glass is used, it may be mounted by placing the handle through a hole in the base board as shown. If a plain lens is to be used, a cheap mount is shown by Fig. 2. A bit of board is cut out as shown, and the hole through it is just a trifle smaller than the lens. A narrow V-shaped groove is then cut around the center of the inside of the hole and a saw kerf run into the board as shown. This allows the lens to be pressed into the groove, and the spring of the wood holds it there.

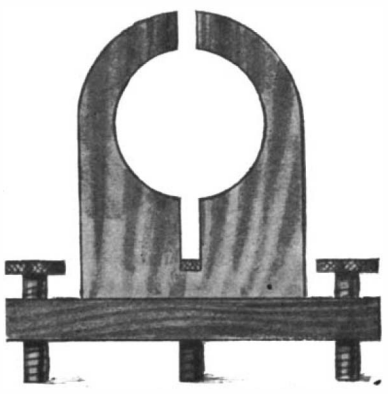


Fig. 2.—METHOD OF MOUNTING PLAIN LENS.

The six leveling screws are common brass wood screws, 4 inches long, about ¼ inch in diameter, with the top of the head filed off flat. The edges of the disk thus formed may be milled in pretty good shape by rolling the edge of the head under a single-cut file of the required degree of fineness. Place the screw on a hard wood board or, better yet, on a sheet of lead, and by rolling under a file, the milling can be quickly done. By all means use a lathe, if you have one, in preference to the file method.

The third member of the family is built on a bit of board cut about 8 inches on a side, of triangular shape, as shown. Three leveling screws are let in and two binding posts are placed in connection with the coil. These posts are shown in the engraving. A common, medium sized lamp chimney is procured and fitted to a circular piece of wood ¾ inch thick. The wood is screwed to the base and the coils are fastened to the wood. The mirror must be placed one meter (39·37 inches) from the scale.

Another circular piece of wood is fitted to the top of the chimney, as shown in Fig. 1. A detail plan and section of this piece is shown by Fig. 3. It is bored out to fit on the chimney, and a ½-inch hole is bored in the center completely through the wood. A wire with a sort of thumb head is bored into the wooden cap so as to pass through the center of the ½-inch hole. A bit of cardboard is glued into the bottom of the large hole, and a pinhole, punched through the exact center, permits the suspension fiber of the needle system to be carried to the wire and wound up by turning the thumb head above described. The coils may be made according to the work to be done. I have three sets of coils with my instrument. The first is made of about 50 feet of single silk copper magnet wire, of such size that it has a resistance of about 8 ohms to the 1,000 feet, about No. 18 or No. 19 B. & S. gage.

A form for winding the coils is shown by Fig. 4. It is made of wood, held together with two screws. A couple of binding wires are laid in before the coil is wound. About six layers of the wire above mentioned can be made out of one-half the 25 feet mentioned. Two of these coils are used, connected in series and to the binding posts. After winding, the binding wires are fastened, the coil is drenched with shellac and placed in the cook stove oven for an hour. The core is then removed, additional binding placed on the coil if found necessary, and again baked at low heat for two or three hours. This holds the coils permanently. Two coils are to be used, and the needle system suspended between the coils, which are placed ⅜ inch apart.

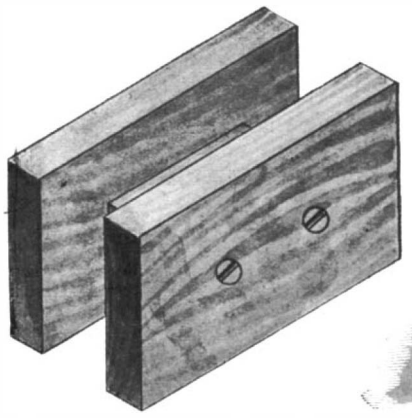


Fig. 4.—FORM FOR WINDING COILS.

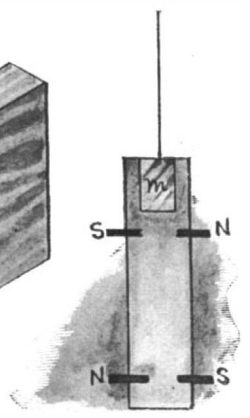


Fig. 5.—NEEDLE SUSPENSION.

I have three coils with my instrument, two in each set, and use either set, as the work demands. I have also three sets of needles, which will be described later. The second set of two coils is wound of No. 33 or No. 34 wire, and has a resistance of about 10 ohms, or 20 ohms for the complete set of two. The third coil is wound with No. 36 wire. Nearly ¼ pound was put on the two coils, and the combined resistance of the complete coil is about 1,000 ohms—500 ohms each.

For the needles with the low-resistance coils I use a common sewing needle. The temper was drawn, the eye and point filed off, leaving a bit of wire 1¼ inches long. A nick was filed in the center, then the needle was hardened and magnetized, and broken through the nick, thus giving two needles magnetized pretty nearly alike. A piece of cardboard 2 inches by ½ inch was pierced, and the needles stuck through it, as in Fig. 5, and held by a drop of hot sealing wax.

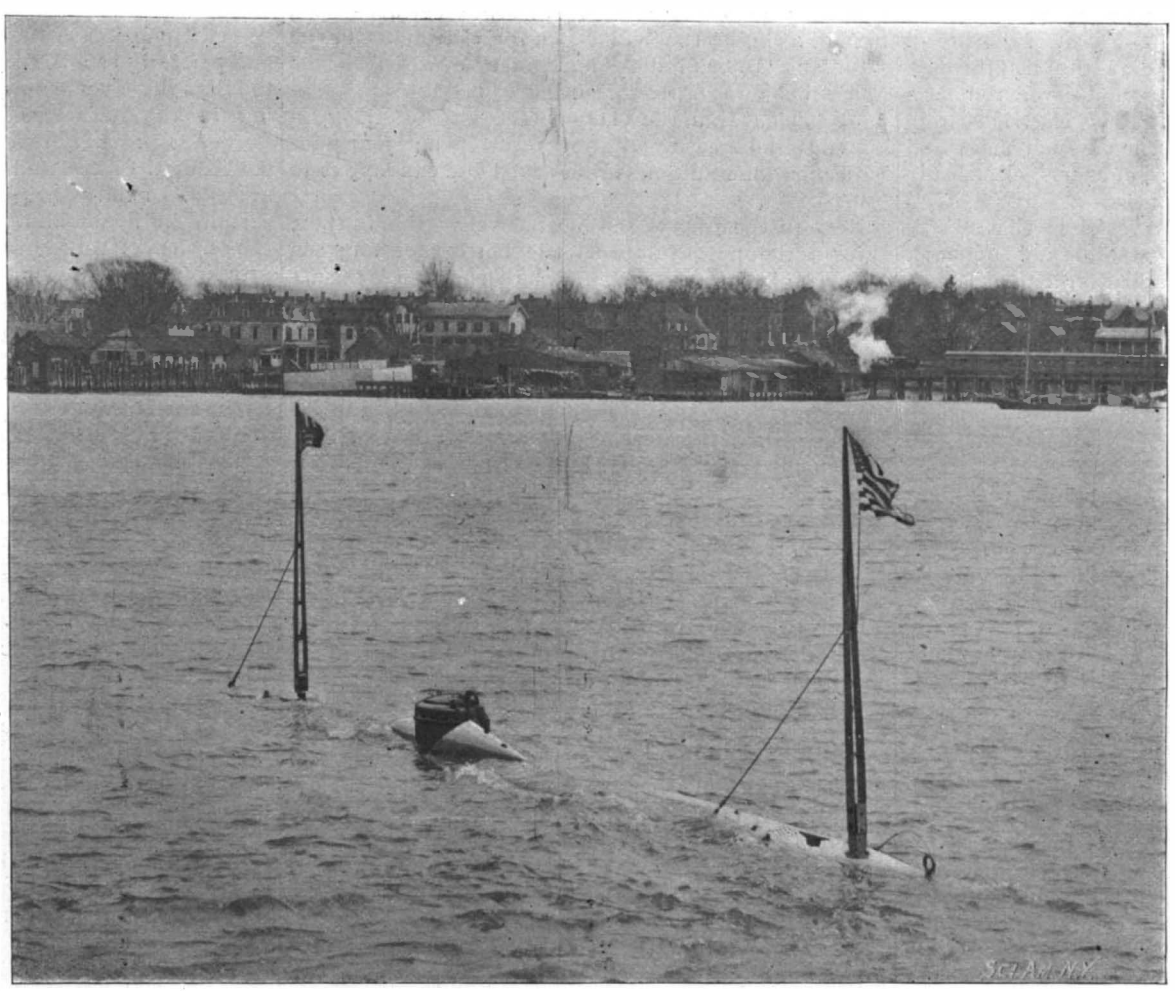
A bit of mirror, m, was waxed to the top of the cardboard, and the suspension fiber fastened between the mirror and the cardboard, as shown. The upper end of the fiber is carried to the cap on the top of the chimney, attached to the thumb head wire, and wound up until the lower needle hangs in the middle of the coil and the upper needle clears the top of the coil about ¼ inch. The instrument is now ready for setting up and adjusting in the usual manner.

The second set of needles is made in the same manner, except that I use pieces of fine watch spring, less than ⅛ inch wide, and place three pieces together, with a single thickness of paper between for each needle. The pieces were file-marked, hardened, magnetized and broken in pieces the same as the needles.

Finding that the light needles and the low-resistance coils gave an instrument readily affected by thermal currents, I made the third set of needles of steel tape about ⅜ inch wide, and used five pieces in each needle, separating each with paper. All the needles in the three systems were ⅝ inch long. The third set made a very heavy set, but in connection with the 1000-ohm coils proved very sensitive, although slow moving.

Different effects were secured by using either set of the needles with the other coils, making six possible combinations. Where extreme sensitiveness is not required, I found it desirable to use a directing magnet, and not depend upon the torsion of the suspension or over-strength of one of the needles, to return the beam of light to zero.

With 1000 ohms in each arm of the bridge and 6 volts in the battery, a considerable deflection is obtained by changing R a single ohm; and with the bridge arranged 1000 to 1, at a and b, the galvanometer readily deflects down beyond the capacity of the bridge, which was 0·001 ohm, with 1000 ohms galvanometer resistance.



THE HOLLAND BOAT AT HIGH SPEED WITH CONNING TOWER ABOVE SURFACE FOR OBSERVATION.

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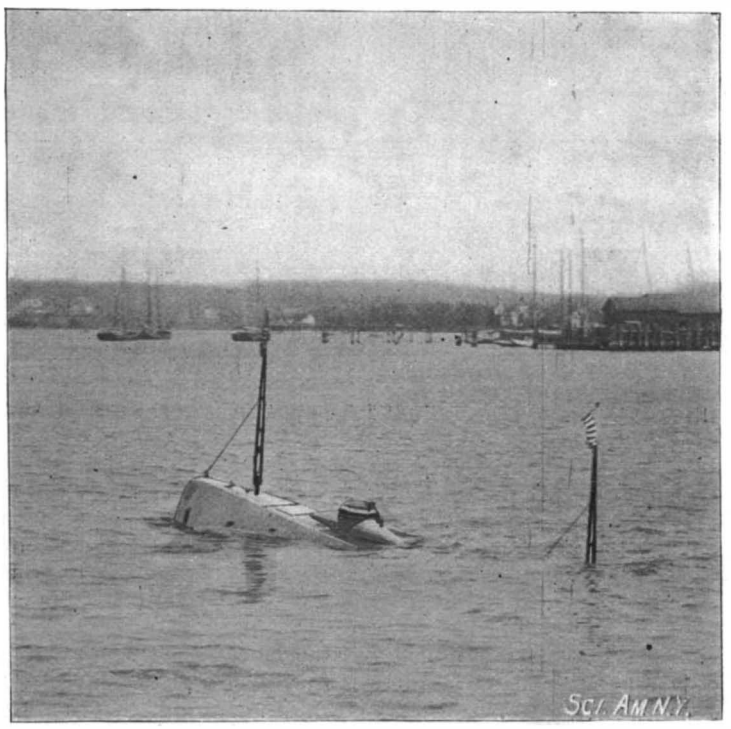
For the suspension in this instrument I used a hair. It was quite fine, micrometered about 0·002 inch in diameter, and was probably from the head of a dark-haired lady. From the needles to the point of suspension there were about 8 inches of effective hair. Just how much better the instrument would be with a raw silk fiber I have no means of knowing at present, but it was as delicate as will be required for any ordinary work.

As to the "figure of merit," I have not had opportunity to determine that point, but will do so, and report later. The "efficiency" of the low-resistance instrument is rather greater than that of the high-resistance form, while the "figure of merit" is greater the more turns of wire are placed on. For measuring very low resistances, the low-resistance coils will give perhaps the best results.

SUCCESSFUL TRIALS OF THE HOLLAND SUBMARINE BOAT.

Extraordinary interest attaches to the trials of the Holland submarine torpedo boat which are now being carried out in New York Harbor, and it gives us much pleasure to state that the results thus far achieved have been very satisfactory. By the courtesy of Mr. John P. Holland, the inventor, our photographer accompanied the boat on her trial runs and secured the photographs which are herewith reproduced. In one of these the little boat is shown at her moorings beside the pier; another was taken when she was running at the surface, with only her conning tower above the water; a third view, perhaps the most striking of all, was taken when the boat was diving, and another view shows the stern torpedo gun and the tail-piece for protecting the rudders. These external views are supplemented by a longitudinal section which shows the construction and leading details of the interior.



DIVING.

The Holland submarine boat embodies the results of some twenty years of experimental work on the part of the designer, who firmly believes that this type is destined to become the most deadly weapon of future naval warfare. This is the first submarine boat of its type ever built and tested. Another and larger boat of the kind is now under construction for the government at Baltimore, and is practically completed; but the progress upon it was so slow that Mr. Holland determined to build at once a smaller vessel for use in harbor defense. The government vessel was described and illustrated in the SCIENTIFIC AMERICAN of April 25, 1896. She is a cigar shaped boat 85 feet long, 11½ feet in diameter and capable of 16 knots speed on the surface and 10 knots when submerged. Her displacement is 168 tons.

The "Holland" (as she is called) is much smaller, being only 55 feet long, 10¼ feet in diameter and of 75 tons displacement. The steel hull is cigar-shaped and approximates somewhat to the model of the Whitehead fish torpedo, being blunter at the head than the tail. Two sources of motive power are furnished, a gas engine being used at the surface and a motor run by storage batteries when the boat is submerged. The storage batteries, which are of great weight, are located amidships, down below the axis of the boat, and as their center of gravity comes well below the center of buoyancy of the hull, the boat is kept at all times on an even keel. Above the storage batteries on each side of the ship are located the compressed air tanks from which fresh air is supplied to the crew when the boat is submerged. The motive power is furnished by a gas engine and an electric motor, both of which operate a common shaft, the gas engine being located just ahead of the motor. The gas engine is used mainly when the boat is running at the surface and the motor when it is entirely submerged. This arrangement, it will be seen, enables the motor to be utilized as a generator for charging the batteries.

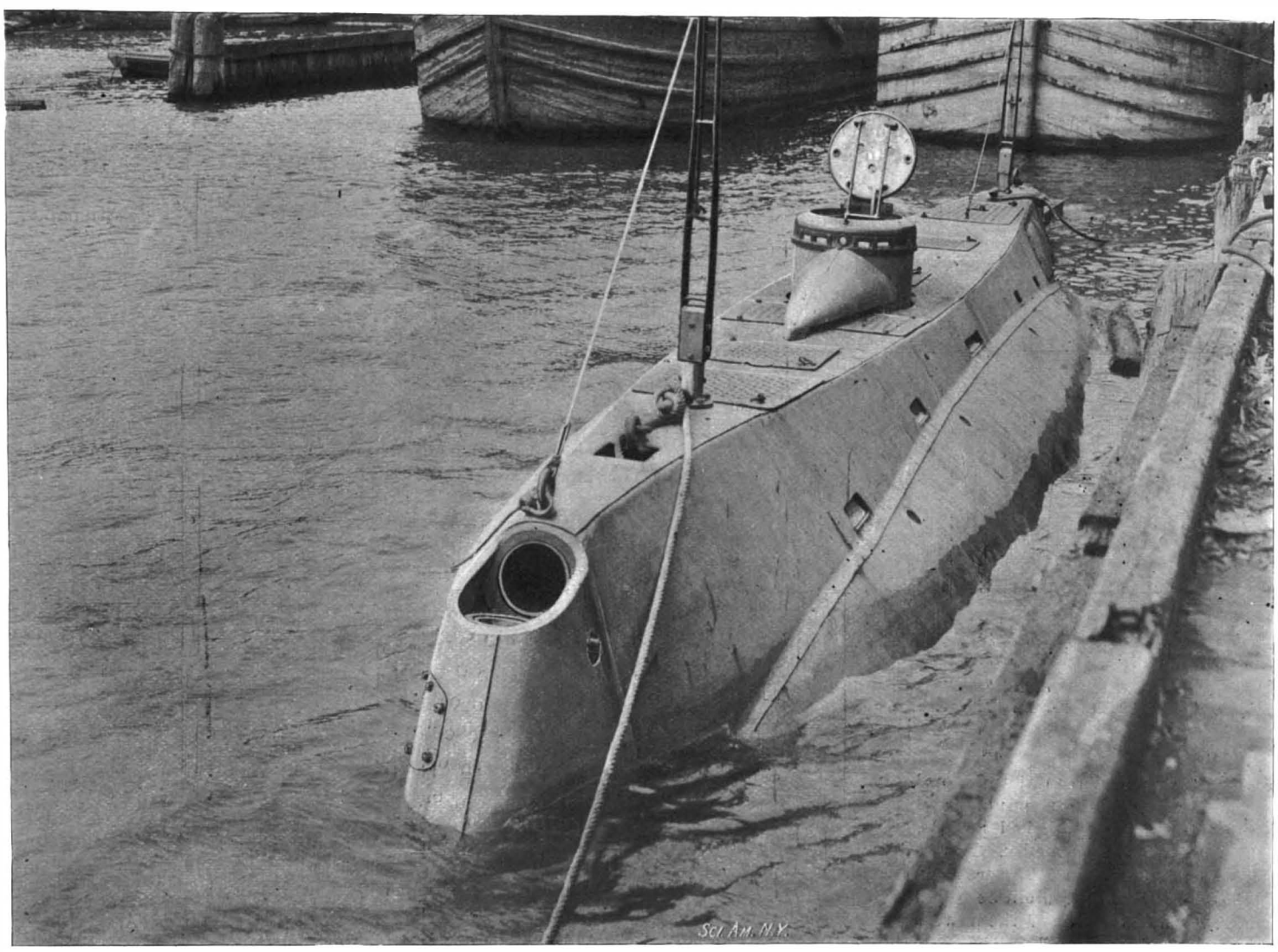
The cellular bottom of the little vessel is utilized for the storage of the liquid fuel, and here are located the water ballast tanks which assist in trimming and in the operation of diving or rising to the surface. With the tanks filled and all the crew aboard there is a reserve buoyancy of 250 pounds, and the boat is caused to sink by altering the pitch of the horizontal diving rudders, the forward motion of the vessel, combined with the downward pitch of the rudders, combining to force her below the surface. She is maintained at the required depth by means of delicate automatic mechanism, similar to that used in the automobile torpedo.

The offensive powers of the Holland are, considering the size and her methods of attack, far greater than those of any other engine of war, whether ashore or afloat. In the first place, she carries in her bow or nose an under-water discharge-tube for launching the deadly Whitehead torpedo. Of these she carries several stowed in a suitable chamber. They are automobile, or self-propelling, carrying their own compressed air engines and a storage tank of compressed air. They are shot out of the bow by a small charge of gunpowder, and as they pass from the discharge tube, a catch releases the little engines and starts the propellers. The torpedo then travels with the speed of the fastest torpedo boat for a distance of from 600 to 1,000 yards. Automatic steering mechanism keeps the flying vessel at the proper depth and on a wonderfully true course.

In addition to the Whitehead torpedoes the "Holland" carries two other discharge tubes for firing guncotton projectiles. Unlike the one just described, which lies in the longitudinal axis of the boat, these are upwardly inclined, one pointing forward and the other aft. The mouths of the tubes terminate at the ends of a kind of superstructure deck which is built up above the cylindrical portion of the boat and carries at the center of its length an armor-plated conning tower. The mouth of each of these tubes is closed by a sliding cover which is operated by means of a worm and pinion controlled by shafts leading into the interior of the vessel. The forward tube is called an aerial torpedo gun. It is capable of throwing a 100-pound guncotton shell a distance of three-quarters of a mile. The other tube, astern, is called an underwater torpedo gun, and it is capable of driving its shell with accuracy for a distance of 200 yards under water.

When the boat is at the surface of the water, she can be steered by observation through the port holes of the conning tower. When she sinks below the surface, a small tube, carrying at its top an inclined mirror or prism, in the manner of the camera lucida, will throw a picture of the surrounding waters upon a board in the conning tower. The vessel also carries a compass and an automatic gage showing the depth below the surface.

In making an attack upon a ship the "Holland" would advance, with her small and scarcely discernible conning tower above water, until she was within range for the use of her aerial torpedo gun. A shell containing 100 pounds of guncotton would be discharged, and she would at once sink below the surface, to avoid retaliation. At the moment of discharge an ingenious system of compensating weights will automatically admit to the tanks a sufficient amount of water to preserve the trim of the vessel. This is an entirely new device, and the "Holland" is the first submarine boat which has succeeded in overcoming the difficulty. When the boat had run up a little nearer to the hostile ship, she would discharge one, and if the first missed, two of her torpedoes. In the unlikely event of missing with the bow torpedoes, she would fire her rear torpedo gun at the enemy as it swept by overhead.



BOW VIEW OF THE "HOLLAND," SHOWING MOUTH OF AERIAL TORPEDO GUN, THE SUPERSTRUCTURE DECK AND THE CONNING TOWER.

Our illustrations were taken during a series of tests which were carried out on March 27, for the benefit of Lieut. Sargeant of the Naval Auxiliary Board. The work was done in 30 feet of water and gave full satisfaction both to Mr. Holland and the government expert. The first trials consisted of a series of surface runs at a speed of 10 knots, in which the boat showed great manuevering power, changing her course through 90° with astonishing rapidity.

The diving test was made at the same speed, and upon the diving rudders being thrown into position, the boat buried her

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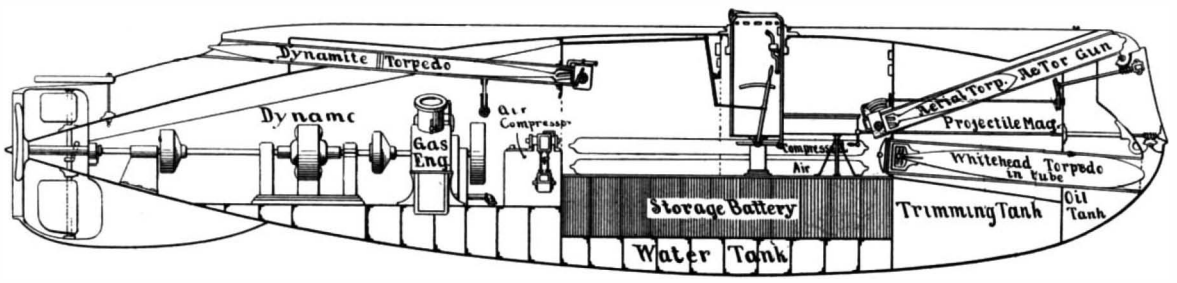
nose and went down at an angle of 15° with the surface. At a depth of 7 feet, as indicated by her flagpoles, she came to an even keel and ran forward steadily for several hundred yards. An ascent was then made, the boat coming up nose first at the same angle as she descended. The cover of the conning tower was then thrown open and Mr. Holland announced that he would dive completely out of sight. One of our illustrations was taken just at this moment and shows the inventor in the act of closing the cover. This time she dived completely out of sight, the flagpoles disappearing altogether. No trace of the vessel was visible until she made her appearance suddenly at a point several hundred yards distant from the point at which the descent was made.

Later a test was made of the bow aerial torpedo gun, and with a reduced air pressure of 600 pounds (as against the full pressure of 2,000 pounds to the square mile) a dummy torpedo was thrown a distance of 500 yards. Further reference to this formidable craft is made in our editorial columns.



LONGITUDINAL SECTION THROUGH HOLLAND SUBMARINE BOAT.

The Book Crop of 1897.

An early number of The Publishers' Weekly gives each year a résume of the book trade of the preceding year, which, though intended primarily for publishers, yet contains matter of interest to readers in general.

In 1897 the number of books issued by the publishers of the United States was 4,928, a less number than had been issued in any previous year since 1893. In that year 4,484 books were published. "The promise of a still increasing volume of publication with which 1896 so hopefully closed," says The Publishers' Weekly, "was not fulfilled in 1897." That it was not, the editor ascribes to the delay over the tariff when the Dingley bill was passed. The general tension being relieved, there was a perfect flood of books during the last six months of the year.

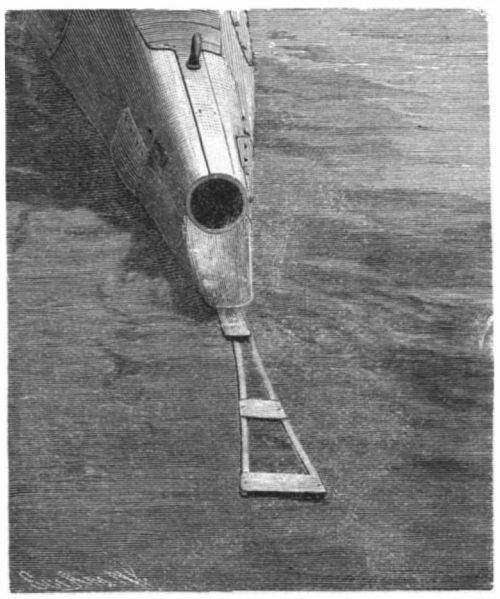
The number of books of permanent value is reported as unusually large; "indeed, few other years in the history of the book trade have so many good works to their credit." It is pleasant to learn that this increase in the number of really good books was accompanied by continued prosperity for the booksellers.

In 1896 the publications amounted to 5,703 volumes; in 1897, to 4,928 only. The shortage was due largely to a decrease in the number of English novels republished here. In 1896 these amounted to 690; in 1897, to barely half, 352 all told. The importations of all classes of books were proportionately the same as hitherto; but the number of American books manufactured was much larger in proportion to the total output, being 3,300 out of 5,703 in 1896, and 3,318 out of 4,928 in 1897—not only a larger actual number, but an increase from 58 to 67 per cent of the total number of books published.

The Publishers' Weekly divides the publications of the year into nineteen principal departments. In each of these, except theology and religion, juvenile, physical and mathematical science, and mental and moral philosophy, there was a falling off in the number of books published from the number published in 1896. "The figures in fiction are most noteworthy. Novels from all sources printed or imported in 1897 were only 869 to 1,114 in 1897. To these, however, might be added the 369 juvenile works, as the majority of them were wholly unsuitable for children's reading."

The principal changes in the other departments may be set forth briefly. On theological and religious subjects 460 books appeared in 1896 and 492 in 1897; 553 law books were published in 1896, as against 509 in 1897; 682 books on literary history, as against 415; 293 books of poetry in 1896 and 247 in 1897; 209 books of memoirs and biography, as against 205; 177 on fine arts, as against 138, and 284 on political science, as against 196. Of the 4,928 different publications, 3,318, as has been said, were produced by American authors and manufactured here; 495, produced by foreigners, were manufactured here; and 1,115 were English works, imported here in sheets or bound. More than one-quarter of the English importations were of novels. In Great Britain the number of publications of 1897 exceeded that of 1896 by 1,353. Of these, 6,244 were new books and 1,682 new editions. In the departments of law, art and science, voyages, travels and research, and "miscellany, including pamphlets but not sermons," there were losses; in every other department, there was a decided gain in 1897 over the output of 1896. In fiction, 38 new novels were published every week, or more than six a day.

France as well as Great Britain records an increase in book production, the number of "books, musical compositions, engravings," being 13,799 in 1897, compared with 12,738 in 1896. Of these 13,799, however, 6,085 were musical compositions, and 1,671 were engravings; the number of books was thus 6,043. Although no details are obtainable, it probably will not wrong the French publishers and book producers to assume that fiction composed a large proportion of these 6,000 books.



STERN VIEW OF THE 'HOLLAND" SHOWING STERN TORPEDO GUN AND TAIL PIECE FOR PROTECTING RUDDERS.

REPORT OF THE NAVAL COURT ON THE DESTRUCTION OF THE "MAINE."

We have before us the printed "Report of the Naval Court of Inquiry upon the Destruction of the United States Battleship 'Maine' in Havana Harbor." It is a volume of some 300 pages, and includes the whole of the testimony given before the court. At the end of the report there are some two dozen photographs and drawings illustrative and descriptive of the wreck.

One does not have to read far in this most extraordinary report before the last charitable hope which one may have had, that the wreck was not a crime but an accident, is shut out, and one is forced to the conclusion that a submarine mine of enormous power was exploded beneath the ill-fated ship.

We have selected from the findings of the report and from the drawings such matter as will place our readers in possession of the full facts of the case. It tells its horrible story with too much distinctness to require much comment by way of explanation.

In the half section and plan of the "Maine" (Fig. 1) the normal and proper position of the keel and bow of the ship as she rode at anchor are shown in fine, unbroken lines. The thick lines show the shape into which these parts were distorted by the explosion. The bow it will be seen was twisted around through an angle of 90 degrees and now lies at right angles to the axis of the ship. The ship is blown completely in two a little forward of amidships, and forward of that, at frame 18, the keel has been blown up into an acute inverted V until it is near the surface of the water, or 30 feet above its normal position. These effects are shown in the drawing (Fig. 4) prepared by Ensign Powelson from the reports of the divers and from his own personal investigation. A more detailed view of this point, marked 1 A in Fig. 1, is shown in Fig. 2.

We give below the full findings of the court:

1. That the United States battleship "Maine" arrived in the harbor of Havana, Cuba, on January 25, 1898, and was taken to buoy 4, in from five and a half to six fathoms of water, by the regular government pilot. The United States consul general at Havana had notified the authorities at that place the previous evening of the intended arrival of the "Maine."

2. The state of discipline on board the "Maine" was excellent, and all orders and regulations in regard to the care and safety of the ship were strictly carried out. All ammunition was stowed in accordance with prescribed instructions, and proper care was taken whenever ammunition was handled. Nothing was stowed in any one of the magazines or shell rooms which was not permitted to be stowed there.

The magazines and shell rooms were always locked after having been opened; and after the destruction of the "Maine" the keys were found in their proper place in the captain's cabin, everything having been reported secure that evening at 8 o'clock. The temperatures of the magazines and shell rooms were taken daily and reported. The only magazine which had an undue amount of heat was the after ten-inch magazine, and that did not explode at the time the "Maine" was destroyed.

The torpedo war heads were all stowed in the after part of the ship under the ward room, and neither caused nor participated in the destruction of the "Maine." The dry guncotton primers and detonators were stowed in the cabin aft and remote from the scene of the explosion. Waste was constantly looked after on board the "Maine" to avoid danger. Special orders in regard to this had been given by the commanding officer. Varnishes, driers, alcohol and other combustibles of this nature were stowed on or above the main deck, and could not have had anything to do with the destruction of the "Maine." The medical stores were stowed aft under the ward room and remote from the scene of the explosion. No dangerous stores of any kind were stowed below in any of the other storerooms.

The coal bunkers were inspected daily. Of these bunkers adjacent to the forward magazines and shell rooms four were empty, namely, B 3, B 4, B 5, B 6. A 15 had been in use that day and A 16 was full of New River coal. This coal had been carefully inspected before receipt on board. The bunker in which it was stowed was accessible on three sides at all times and the fourth side at this time, on account of bunkers B 4 and B 6 being empty. This bunker, A 16, had been inspected that day by the engineer officer on duty. The fire alarms in the bunkers were in working order, and there had never been a case of spontaneous combustion of coal on board the "Maine."

The two after boilers of the ship were in use at the time of the disaster, but for auxiliary purposes only, with a comparatively low pressure of steam, and being tended by a reliable watch. These boilers could not have caused the explosion of the ship. The four forward boilers have since been found by the divers and are in a fair condition. On the night of the destruction of the "Maine" everything had been reported secure for the night at 8 o'clock by reliable persons through the proper authorities to the commanding officer. At the time the "Maine" was destroyed the ship was quiet, and therefore least liable to accident caused by movements of those on board.

3. The destruction of the "Maine" occurred at 9:40 P. M., February 15, 1898, in the harbor of Havana, Cuba, she being at the time moored to the same buoy to which she had been taken upon her arrival. There were two explosions, of a distinctly different character, with a very short but distinct interval between them, and the forward part of the ship was lifted to a marked degree at the time of the first explosion. The first explosion was more in the nature of a report like that of a gun, while the second explosion was more open, prolonged and of greater volume. The second explosion was, in the opinion of the court, caused by the partial explosion of two or more of the forward magazines of the "Maine."

CONNING TOWER OF HOLLAND BOAT.

4. The evidence bearing upon this, being principally obtained from divers, did not enable the court to form a definite conclusion as to the condition of the wreck, although it was established that the after part of the ship was practically intact, and sank in that condition a very few minutes after the destruction of the forward part. The following facts in regard to the

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forward part of the ship are established by the testimony:

A portion of the port side of the protective deck which extends from about frame 30 to about frame 41 was blown up aft and over to port. The main deck from about frame 30 to about frame 41 was blown up aft and slightly over to starboard, folding the forward part of the middle superstructure over and on top of the after part. This was, in the opinion of the court, caused by the partial explosion of two or more of the forward magazines of the "Maine."

5. At frame 17 the outer shell of the ship, from a point 11½ feet from the middle of the ship and 6 feet above the keel when in its normal position, has been forced up so as to be now about 4 feet above the surface of the water; therefore, about 34 feet above where it would be had the ship sunk uninjured. The outside bottom plating is bent into a reversed V shape (Λ), the after wing of which, about 15 feet broad and 32 feet in length (from frame 17 to frame 25), is doubled back upon itself against the continuation of the same plating extending forward.

At frame 18 the vertical keel is broken in two and the flat keel bent into an angle similar to the angle formed by the outside bottom plating. This break is now about 6 feet below the surface of the water and about 30 feet above its normal position.

In the opinion of the court this effect could have been produced only by the explosion of a mine situated under the bottom of the ship at about frame 18 and somewhat on the port side of the ship.

6. The court finds that the loss of the "Maine" on the occasion named was not in any respect due to fault or negligence on the part of any of the officers or members of the crew of said vessel.

7. In the opinion of the court the "Maine" was destroyed by the explosion of a submarine mine, which caused the partial explosion of two or more of her forward magazines.

8. The court has been unable to obtain evidence fixing the responsibility for the destruction of the "Maine" upon any person or persons.

W. T. SAMPSON, Captain, U. S. N., President.
A. MARIX, Lieutenant-Commander, U. S. N., Judge Advocate.

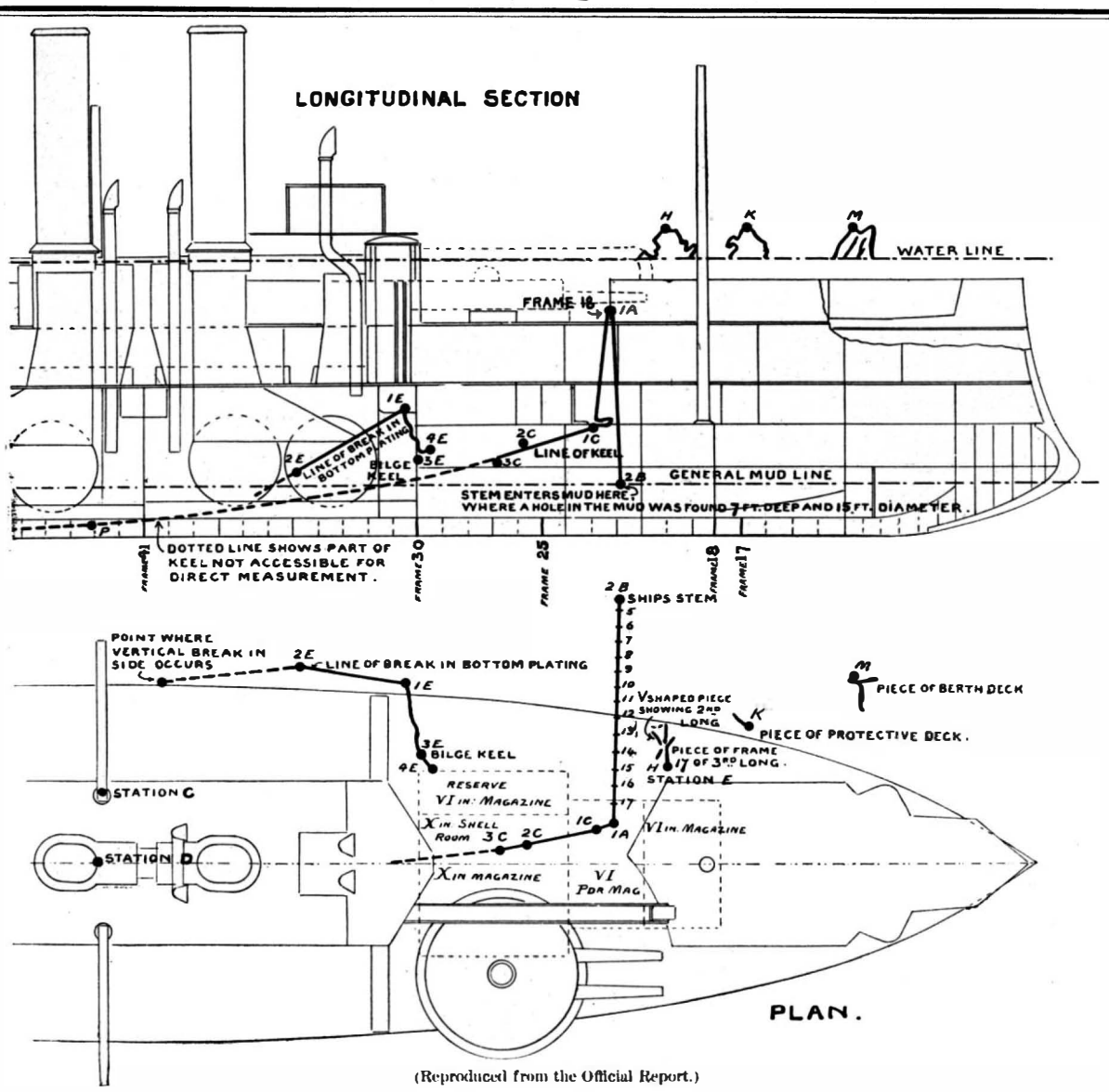
UNITED STATES FLAGSHIP NEW YORK,
March 22, 1898, off Key West, Fla.

The proceedings and findings of the Court of Inquiry in the above case are approved.

M. SICARD, Rear Admiral,
Commander-in-Chief of the United States Naval Forces on the North Atlantic Station.

It should be mentioned that Capt. Sigsbee stated during his examination that he had been informed by the captain of the "City of Washington" that "he had never known, in all his experience, which covers visits to Havana for five or six years, a man-of-war to be anchored at that buoy," at the buoy at which the "Maine" was anchored, "and that he had rarely known merchant vessels to be anchored there, and *that it was the least used buoy in the harbor*."

Commander G. A. Converse, United States navy, was summoned by the court as an expert witness on the action of explosives. He testified that he had been thirty-six and a half years in the naval service, and had made a careful study of the nature and effects of explosives. His experience included eleven years spent at the naval torpedo station. The importance of the testimony of Capt. Converse is such as to warrant its being given in full.



(Reproduced from the Official Report.)

Fig. 1.—DIAGRAM SHOWING BY HEAVY LINES THE PRESENT POSITION OF KEEL AND BOW OF "MAINE."

Sketch showing vertical keel broken and flat keel plates bent, in present position at point marked 1 A on projection of injuries. Redrawn from drawing made by Chief Gunner's Mate A. Olsson, U.S.N. (diver).

(Reproduced from the Official Report.)

Fig. 2.—SKETCH SHOWING BROKEN KEEL AT POINT MARKED 1 A IN FIG. 1.

Q. Captain, will you please examine the sketches which have been shown you and tell the court whether, in your opinion the explosion of one or all of these forward magazines, or their partial explosion, would leave the bottom of the ship in the condition which now exists, as represented in these sketches?

(Exhibit H was shown witness.)

A. The sketch might represent two explosions of entirely different natures. That part of the sketch represented here as frame 14½ to frame 18½, aft, in the direction of frame 23, might be produced by the explosion of a comparatively large mine of not violent explosive matter at some distance below the bottom of the ship; whereas the part abaft of frame 23 has all the appearance of the effect produced on iron plates by a high explosive in close proximity to it. There are in all explosions two general effects: First, the upheaval of the water caused by the direct action of the explosion, followed almost immediately afterward by the second upheaval of water and mud, being the reaction of the water from the sides and the bottom, which rushes in to fill the crater produced by the first explosion. But the location of this upheaval and the distortion of the keel in the present instance does not appear to have been formed by the secondary effect referred to above. It is too far forward; too remote. It is too far from the place marked "Débris," which must be somewhere about frame 27. If that is 27, then the distance, as marked, from frame 18, will be eleven frame spaces, or 44 feet forward of what would appear to be the crater of the most violent explosion.

Q. Then to what kind of an explosion do you attribute the force that caused this bending of plates and keel on sketch?

A. I am of the opinion that it could be produced by the explosion of a submarine mine containing a large amount of the lower explosives—gunpowder or similar—not in contact with the ship, but some distance below it, perhaps on the bottom.

Q. Looking at the sketch shown you, especially at that portion of the keel which has frame 18 on top, and the plates—bent plates—forward of it, excluding entirely all portion abaft of it, could this part which you are now told to consider have become so distorted from the effects of an internal explosion alone?

A. I do not think it could. I have never seen anything in my experience which would lead me to believe that it is possible to produce the effect indicated by any explosion within the interior of the ship in that immediate vicinity.

Q. Looking at the sketch shown you, and informing you that the forward 6-inch magazine and the fixed ammunition room were at that part of the keel which is represented as nearly vertical—that is, frame 18 to frame 24—could the conditions as shown forward of frame 24 have been caused by an explosion of those two magazines or of any magazine abaft of frame 24?

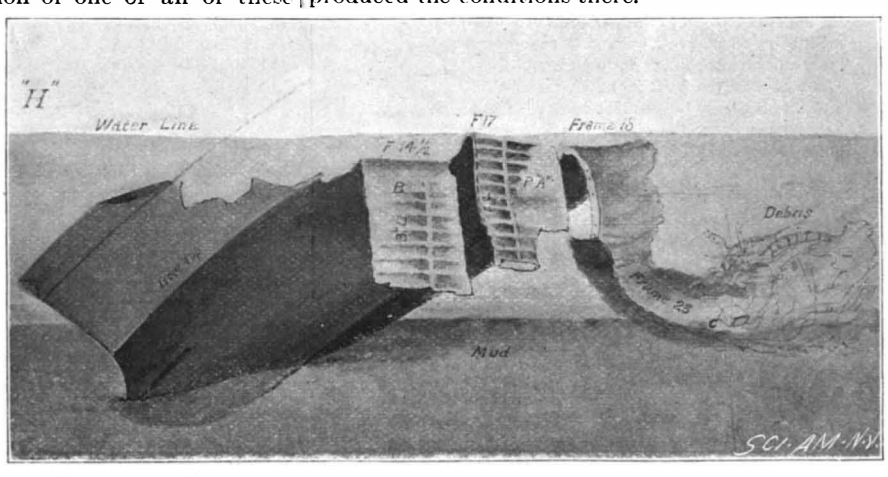
A. I do not think it could.

Q. Do you think, then, necessarily, there must have been an underwater mine to produce these explosions?

A. Indications are that an underwater explosion produced the conditions there.

(Reproduced from the Official Report.)

Fig. 3.—VIEW ABOVE FORE PART OF WRECK SHOWING PART OF FRAME 17 PIECE OF PROTECTIVE DECK AND PIECE OF BERTH DECK.



(Reproduced from the Official Report.)

Fig. 4.—FACSIMILE OF OFFICIAL SKETCH (EXHIBIT H) SHOWING CONDITION OF WRECK UNDER WATER AS FAR AFT AS FRAME 28.

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RECENTLY PATENTED INVENTIONS.

Engineering.

ROTARY ENGINE.—Paul J. Johnson, Los Angeles, Cal. Within the cylinder of this engine, on the end of the main driving shaft, is a hub eccentric to the cylinder, and the piston, sliding diametrically in the hub, has at each end a steam-pressed head engaging the inner surface of the cylinder. A slide valve, shifted by a hand lever, admits steam to either one of two ports for going ahead or reversing, and the piston, slidable in the hub, has at each end a chamber in which slides a shank of the piston head, there being two ports at each end of the piston and in each chamber a double valve. As the piston revolves the head is forced outward in engagement with the inner surface of the cylinder by the operation of the double valve, the steam being absolutely confined in the cylinder until it reaches the exhaust, there being no loss of power and no lost motion.

TENDER FOR TRACTION ENGINES.—Edward G. Ferguson and John P. Holmen, Kensett, Ia. The engine, according to this invention, has on its boiler rearwardly projecting brackets, while secured to the brackets are side bars extending from the body of a two-wheeled vehicle having pivotal connection with its axle, a drum journaled in the brackets being operated by the steering mechanism of the engine, while a chain winding on the drum is connected at its ends with the axle of the vehicle. By this means the engine and tender may be simultaneously steered, and may be as readily moved rearward as forward without danger of upsetting.

Railway Appliances.

RAILWAY TIE AND RAIL CLAMP.—Charles H. Rogers, New York City. A metallic tie, according to this invention, has slots in which the rail is received, and mechanically operated rail clamps capable of being manipulated from one end of the tie to carry the clamps into locking engagement with the tie. The necessity of a gage is dispensed with. The tie is simple and inexpensive, and may be used in connection with a wooden sleeper or foundation, or a foundation of concrete, etc.

RAIL SANDER.—Herbert L. Graham, Augusta, Ga. An improved mechanism for delivering sand from the sand box of a locomotive to the rails is provided by this invention, the sanding device being certain in its operation, feeding the sand rapidly or slowly as desired, and not being liable to become clogged. It comprises a straight pipe extending beneath and having a branch connection with the sand box, whereby the sand is fed to the nozzle by gravity, a conveying pipe leading from one end of the nozzle pipe, while an air-blast pipe enters the other end and terminates in a nozzle just beyond the connection to the sand box. The improvement may be applied to any sand box now in place without changing the ordinary hand-feeding mechanism.

Electrical.

DROP SIGNAL APPARATUS.—Oscar A. Danielson, Owatonna, Minn. This invention relates to apparatus used in connection with telephone exchange switchboards, and provides means designed to prevent induction and, consequently, obviate cross talk. Instead of using a single magnet for each drop, a series of magnets is so employed, each set comprising a number of magnets, and adjacent sets being so arranged that magnets of one set will oppose magnets of the adjacent set. The magnets of each group are oppositely wound, there being a soft iron plate for each group and a board upon which the several groups are arranged, the groups being so arranged that the positive magnets of one set oppose negative and positive magnets of an adjacent set.

CLUSTER LAMP FIXTURE.—Nelson Weeks, New York City. This invention provides a comparatively inexpensive fixture that is neat and compact in appearance, and which may be applied directly to a ceiling, wall or other support, and in which the usual short extended ends of the house wiring may be attached directly to the lamp contacts. It comprises a base carrying a series of electrically connected screw plugs, there being connections between the plugs and the leading-in wires, while a cap on the base has a plurality of openings to receive lamp bases. Contact plates on the walls of the openings have projections to engage the ring terminals of the lamps, the projections engaging with certain of the contacts on the base, and there being means for electrically connecting the contact plates.

Agricultural.

SUGAR CANE HEADER.—Charles W. Mac Williams, Preston, Canada. This is a machine for cutting off the tops or heads, and, consequently, the seed from sugar cane, Milo maize, and like crops, in the harvesting of which it is desirable to cut off only the heads, leaving the stalks standing. The machine may be readily placed in a wagon body and the knives raised or lowered to accommodate them to the height of the stalks, the adjustment being effected in a quick and convenient manner, and means are provided for conducting the severed tops from the knives back into the wagon body. The wagon tongue is also so formed that the stalks will pass between its members, the stalks remaining upright, and not being trampled upon by the draught animals.

Miscellaneous.

MAILING TUBES, CANS, ETC.—Edward Sands, Chicago, Ill. Two patents have been granted this inventor relating to the manufacture of mailing tubes, cans and similar articles from sheets of paper, strawboard, etc., whereby the layers or laps, after rolling the sheets into tubular form, are securely united and at a comparatively low cost. The sheets are provided with one or more strips of an adhesive substance of high quality, such as glue, and with a coating of cheaper adhesive, such as paste, adjacent to or between the strips, the glue strips drying and holding as soon as the tube is rolled, and thus holding the tube or can in its correct form until the paste dries and performs its share of the joining. According to this method, but a small quantity of glue need be used, and the articles may be cheaply manufactured without impairing their durability.

CONSTRUCTION OF CEILINGS.—Louis Aronowitz, New York City. According to this invention, panels are formed of bars and connecting links in such manner that they may be folded for transportation and inserted between the flanges of the ordinary floor beams, where they are expanded into normal shape. The parts are all securely fastened together, each supporting the other to make a strong and rigid structure, which may also be used for floors, and the panels may be put together at a shop in sections of considerable length, enabling the handwork to be done where especial facilities are provided for assembling the parts, so that but little labor need be done at the building.

LOG HAULER.—Thomas J. St. Louis, West Superior, Wis. To facilitate the hauling of logs by means of steam power instead of by horses, this inventor provides a device which may exert its power without tearing up the roadway or without using rails, employing in the work a stationary chain stretched along the roadway and fastened at each end. The chain is engaged by a chain hauling or winding mechanism mounted on a suitable frame supported on runners to permit the sled or bob under each end of the frame to pivot in going about curves or in passing obstructions. Means are also provided for cutting ruts or tracks in which will travel the runners of the sleds on which the logs are loaded, so that all the sleds will follow in the same track, it being expected that the tracks will be in hard snow, or ice made by freezing water poured therein.

FOLDING TOP FOR VEHICLES.—Morris Kassmayer, New York City. This top is arranged to permit the occupant of the vehicle to conveniently and quickly raise or lower the top without leaving the seat, the top when lowered being completely folded in the seat casing. The top is made with a lower folding section, a middle non-collapsible section, and an upper extension section or hood, which may or may not be used, and is adapted to be folded within a casing at the rear of the seat, or to be elevated, by turning a crank at the front of the seat at one side, the crankshaft being connected with gear wheels which are connected with racks from which rods extend to the frame bows.

PRODUCING ALCOHOL AND YEAST.—Johannes C. Boot, Bath Beach, N. Y. To produce alcohol and yeast from substances such as sirups, molasses, sugar and saccharified amylaceous substances, this inventor ferments the saccharine substances in the presence of a chromium compound, whereby secondary fermentations are prevented, and the main fermentation may be completed in a short time, while the products of fermentation are pure and the alcohol is obtained in larger quantities than according to the processes heretofore used.

SHARPENING HORSESHOE CALKS.—James L. Martin, Marion Centre, Pa. A simple machine by which the calks of a horseshoe may be restored to their proper shape or sharpened, without removing the shoe from the hoof, according to this invention, consists of a frame with an operating lever and shaping levers pivoted at opposite sides in the frame, the inner surfaces of the latter levers being shaping surfaces, and there being link connections between the shaping levers and the operating lever.

GLASS MOULDING MACHINE.—Lawrence H. Dolan, Alexandria, Ind. This invention relates to a machine in which a separable mould is employed, in which the hollow article to be produced from molten glass is blown while the mould is closed and released when the mould is opened. A two-part closable paste mould is used and a douche tank, there being means for moving the mould into and out of the tank by pressure of the foot of the operator, and means for closing the normally open mould by foot pressure. The machine is especially adapted for the rapid and perfect production of electrolier bulbs or other hollow glassware by a work man, without requiring an assistant.

AUTOMATIC WINDMILL REGULATOR.—George S. Long, Hinckley, Ill. This invention provides a mechanism for automatically throwing windwheels into or out of the wind, for the purpose of stopping or pumping of water. Combined with rotatable ratchet disks on the hub of which the windwheel chain winds, is a pump rod, lever and weighted push and locking pawls, in connection with a float and balance weight, the rising of the water in the tank, and the consequent lifting of the float, throwing the wheel out of the wind when the tank is full, and the dropping of the float with the withdrawal of water from the tank allowing the wheel again to fall into the wind.

WATER WHEEL.—Charles T. Monroe, Wisdom, Mont. To so construct a wheel that practically all the water running into it will be utilized is the object of this invention, the arrangement being such that the stoppage of the wheel will act as a cutoff to store unused water. Mounted to rotate in a suitable casing is a wheel carrying radial blades or buckets, flanges on the wheel forming the outer walls of the buckets, while a water-fed pipe extending into the casing has lateral outlets, the pipe being adapted to engage against the inner ends of opposite blades to form the inner walls of the buckets.

GUITAR OR LIKE INSTRUMENT.—Charles M. Borcur, Dodge City, Kansas. An improved construction of guitar bridges and an improvement in the manner of fastening the strings, is provided by this invention, the openings for the strings being so located and the bridge and top so reinforced that neither the bridge nor the upper face of the guitar will be injured when the strings are placed under severe tension. The strings may not only be attached to the bridge, but the bight of the strings is engaged by a cross bar on the under face of the upper board of the instrument, thus preserving the board against undue strain and causing the strain to be sustained jointly by the bridge and the transverse bar.

MUSICAL INSTRUMENT.—Charles Nalence, New York City. For pianos, harps, autoharps, phonoharps, banjos, mandolins, etc., this invention provides improvements whereby the strings are operated on by a striker in such manner that either a solid tone or a tremolo is produced, the device being also arranged to be used as a silent clavier. The instrument is provided with a movable support on which is an adjustable rod having a flexible connection with a striker to hold it suspended or move it nearer to or farther from the strings. After the striker has been propelled against the strings by the action of the support, it returns to its former position by its own gravity.

BLOWPIPE.—Charles H. King, Granite Falls, Minn. A device that will blow a very strong heat without blackening the metal being soldered or treated is provided by this invention. The improvement comprises a boiler adjustably held on a standard above a heating lamp, the boiler communicating with a blowpipe extending over a flame lamp, while a deflecting plate depends from a hood mounted on the tray or base, the hood mainly surrounding the flame lamp. Alcohol is preferably used in the lamps and in the boiler, and the construction is comparatively inexpensive. The blowpipe extends upward from the boiler into a condensing chamber, from the upper part of which the blowpipe proper leads to the flame.

TRANSPORTATION TICKET.—Samuel Lumpkin, Atlanta, Ga. A ticket applicable in all modes of transportation, to be carried out by straight or round trips, or by means of whole or half tickets, is provided by this invention, the purpose being to prevent the use of tickets by other than the original purchaser. The ticket has a slot and offsets forming stops, a sleeve or pocket sliding on the ticket being limited in its movement by the offsets, while a tongue held at one end to the sleeve is movable at its other end through slots in the sleeve and ticket. The use of the ticket involves the concealing of an identification portion, and successively unsealing it and resealing it by the several officials in the order of the coupons passed upon.

LOCK.—Walter and Paul Wolfgramm, Guben, Germany. This is an improved safety lock having groups of tumblers lodged one above the other in pairs, which may vary in number and be so arranged that the separate tumblers of each individual pair are not in contact with each other when the lock is opened, while at the moment of closing there is a distribution or rearrangement in position of the different groups or pairs of tumblers, which is brought about by the arrangement of the parts of the key bit and their direct action on the lower tumblers of each group. By using a key to which a variety of bit forms may be given, a large number of ways of closing and locking the lock mechanism is provided, each one differing from all the rest, as the lock can be opened only by a key having exactly the same arrangement of bit as that which closed the lock.

LINEWAY.—Martin F. Kohinka, Scotia, Cal. To facilitate the lifting and transporting of timber, this invention provides for a line run taut at an inclination so that a carriage may roll along the line, the carriage being dropped to the ground on relaxation of the tension on the line. The invention supposes the line connecting two trestles or elevated structures of differing height, the line being attached to one of the trestles and running over the other, the line being made slack or taut by a winding apparatus, while a second line, also provided with a winding device, is attached to the ground at one trestle and runs over the other trestle.

TRANSOM LIFTER.—Oscar C. Rixson, Chicago, Ill. This device is of simple construction, easily manipulated, and applicable to transoms hinged either at the top, middle or bottom, while being completely hidden from view. A rack bar is mounted to slide in a guideway within the door casing and a link pivotally connects the rack bar with the transom, there being a gear wheel in mesh with the rack bar and a pinion in mesh with the gear wheel, while a spindle, which may be locked in place as desired, engages the pinion and is under the convenient control of the operator, the device not being liable to get out of order and not forming an unsightly obstruction on the outside of the door.

DOOR SADDLE.—Richard Wilson, New York City. A threshold strip, according to this invention, is so made as to entirely close the space between the door and the threshold, the closing medium having a rotary and a vertical movement, and being located within the saddle or threshold strip, entirely out of the way. The threshold strip has a longitudinal opening in which a roller rests upon bearings, springs normally holding a portion of the roller above the upper surface of the threshold, while an adjustable strip supports the springs.

THILL COUPLING.—Silas Speed, Barron, Wis. The clip section, according to this invention, has end ring bearings provided with entering slots and an intermediate cushion, and the thill section has lugs fitting in the bearing rings and overlapping the slots when the thill section is in position for use, the cushion then pressing the thill section to set its lugs tightly in the bearing rings overlapping the slots. The cushion may be a rubber block and also serves as an effective anti-rattler.

SHELVING.—Orville J. Hubbard, Buffalo Center, Iowa. According to this invention, a series of shelves is formed of bars arranged in horizontal lines to support and display goods advantageously without permitting the usual accumulation of dust, the construction also preventing the access of rats and mice to the goods. The parallel bars are preferably tubular, and the shelves may be readily adjusted to the desired height.

SALT SHAKER.—William M. Myers, Hannibal, Mo. Within the body of this shaker is a cone-shaped discharge tube, with its small open end uppermost, its sides closed and its lower large end coinciding with and fitting in the bottom outlet opening of the body. The salt or other article to be shaken out is held in the space around the conical discharge tube, and the shaker has a conical lid by which, on a quick upward and downward movement, the salt or other article is caused to enter the small upper end of the discharge tube, the quantity discharged varying with the angle at which the shaker is held.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

RECENT ANALYSIS OF CIGARETTES.

I desire to supplement my remarks on the cigarette (THE SCIENTIFIC AMERICAN, vol. lxviii., No. 11, p. 173) with the following analysis made by J. W. MALLET, Professor of Chemistry in the University of Virginia.

JOHN WALLACE.

UNIVERSITY OF VIRGINIA,
CHARLOTTESVILLE, VA.,
February 7, 1898.

Having purchased, in open market, at Charlottesville, Va., large samples, in original, unbroken, manufacturers' packages, of the following brands of cigarettes, viz., No. 1, No. 2, No. 3, No. 4, No. 5,* I have carefully examined these samples and find them to consist of good, light-yellow tobacco, with wrappers of thin, delicate paper.

The percentage of nicotine in the (air-dried) tobacco was found to be:

No. 1	1·19
No. 2	1·08
No. 3	1·24
No. 4	1·36
No. 5	1·17

On being burned, the tobacco and paper respectively left the following amounts of ash, counted on the materials in their original air-dried state:

	Tobacco. Per cent of ash.	Paper. Per cent of ash.
No. 1	13·43	2·81
No. 2	13·41	0·79
No. 3	11·65	2·03
No. 4	13·35	2·05
No. 5	13·17	2·56

The average weights of the tobacco and paper respectively of *a single cigarette* (air-dry), and of the ash from same, were:

One Cigarette.

	Original Material.		Ash.	
	Tobacco. Grains.	Paper. Grains.	Tobacco. Grains.	Paper. Grains.
No. 1	17·24	0·60	2·32	0·017
No. 2	21·53	0·62	2·89	0·005
No. 3	16·76	0·68	1·95	0·014
No. 4	16·98	0·60	2·27	0·012
No. 5	16·04	0·60	2·11	0·015

Both tobacco and paper were, in very considerable quantity, carefully examined for the noxious foreign ingredients which have sometimes been said to be added in the process of manufacture. None of these could be found. Neither morphine nor any other characteristic constituent of opium was detected; nor was atropine, strychnine, cocaine or any other fixed alkaloid present in the tobacco. No traces were obtainable of any compound of arsenic, lead or copper in the paper.

The whole examination lends no support to the *sensational stories* occasionally circulated in regard to *dangerous adulteration* of cigarettes. J. W. MALLET.

* I have no desire to advertise the particular brands of cigarettes analyzed; hence I have substituted numbers. I shall be pleased to furnish the names by letter to any one who is sufficiently interested in the subject to desire to have them.

Business and Personal.

The charge for insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

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NEW BOOKS, ETC.

THE SHIPPING WORLD YEAR BOOK. Edited by Major Jones. Port directory of the world, tariffs of all nations, etc. 1898. Pp. xxxii, 1054.

This is a very useful book. It is filled with matters very important to all who are in any way interested in shipping. It is convenient to have the tariffs of all nations in a condensed and handy form. The tariffs are corrected to December 15, 1897. The port directory includes all of the ports of the world, with memoranda as to charges of pilotage, etc.

TRIBUNE ALMANAC AND POLITICAL REGISTER FOR 1898. Henry E. Rhoades, editor. New York: The Tribune Association. 1898. Pp. 336.

The Tribune Almanac is always a welcome visitor. It is particularly valuable to those who are interested in any way with political matters, as it probably goes into this subject more fully than any other almanac or manual.

PUBLICATIONS OF THE UNITED STATES COMMISSION OF FISH AND FISHERIES AVAILABLE FOR DISTRIBUTION ON JUNE 30, 1897. Extracted from United States Fish Commissioner's Report of 1896. Appendix 7. Pp. 343 to 356. Washington. 1897.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Minerals sent for examination should be distinctly marked or labeled.

(7389) E. A. L. asks: Will you publish a formula and directions for making library paste? A. 1. Tragacanth, 1 ounce; gum arabic, 4 ounces; water, 1 pint. Dissolve, strain, and add thymol, 14 grains; glycerine, 4 ounces; and water to make 2 pints. Shake or stir before using it. Swell the tragacanth in cold water. 2. Rye flour, 4 ounces; alum, ½ ounce; water, 8 ounces. Rub to a smooth paste, pour into a pint of boiling water, heat until thick, and finally add glycerine, 1 ounce; and oil of cloves, 30 drops. 3. Rye flour, 4 ounces; water, 1 pint. Mix, strain, add nitric acid, 1 drachm, heat until thickened, and finally add carbolic acid, 10 minims; oil of cloves, 10 minims; and glycerine, 1 ounce. 4. Dextrin, 8 parts; water, 10 parts; acetic acid, 2 parts. Mix to a smooth paste, and add alcohol, 2 parts. This is suitable for bottles of wood, but not for tin, for which the first three are likewise adapted.

(7390) F. H. B. writes: I am trying to make dynamo out of the simple electric motor 641, also in "Experimental Science," and would like you to inform me what size wire and how many turns will I wind on each coil of magnet. I have made the armature the same as the eight light dynamo described in one of your papers. It has 12 coils, 28 turns on each coil, size of wire No. 20 double cotton. I would like to get the best results possible, that is 110 or 50 volts, and as many amperes possible. Kindly let me know the size wire, the voltage and amperes, also at what speed it is to run. A. Wind on the armature as many turns of No. 24 wire as you can put on, keeping the same number in each coil. Wind on each field 400 feet of No. 20 wire, 1,600 feet in all, connect in series with the armature. The speed should be about 2,000 per minute; the voltage, 40.

(7391) A. S. asks: 1. Where can I get the eighty feet of tin foil 6 inches wide for the condenser of the coil described in SUPPLEMENT, No. 160, also the glass tubes and egg shaped vessels described in SUPPLEMENT, No. 166? A. Address any dealer in electric supplies or physical apparatus. Our advertising columns will furnish this information. 2. Does it make any difference which side I start the secondary? A. No. 3. In regard to the spring of vibrator, drawings in SUPPLEMENT are one-half size. Then the spring would be 1-16 thick, ½ wide and 2½ long, which would be much too heavy for a spring. Please state thickness of Brown & Sharpe gage if possible. A. The thickness of brass is not a guide to its elasticity. Use a moderately stiff piece of spring brass and file it till it works properly. Use judgment and experiment till you have what you want. 4. Would it be better to shellac the wires in the core? Each wire, I mean. A. The layer of oxide which forms on the wires when they are heated to soften them will protect them sufficiently.

(7392) G. N. M. asks: Is black considered a color by itself, generally speaking? In what relation does it stand to other colors? A. In a strict sense black is not a color. It denotes the absence of light and therefore of color. It absorbs all sorts of light which falls upon it and gives none back again. Yet in ordinary speech black is used as an attribute of the word color, as a black color. See the Century Dictionary under this word.

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Fence post, P. M. Mishler 601,548
Fence, wire, Neil & Bissell 601,272
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Fencing, machine for making wire, P. Sommer et al (reissue) 11,658
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Furnace. See Electric furnace.
Furnace grate, J. Thurell 601,601

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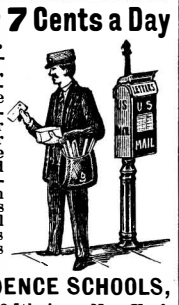

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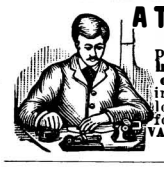

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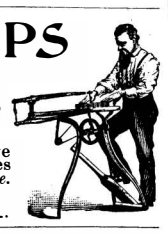

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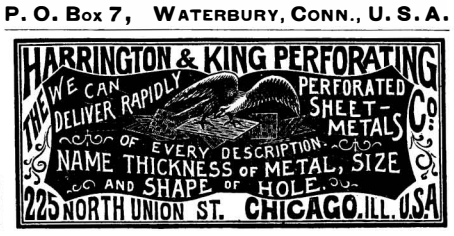
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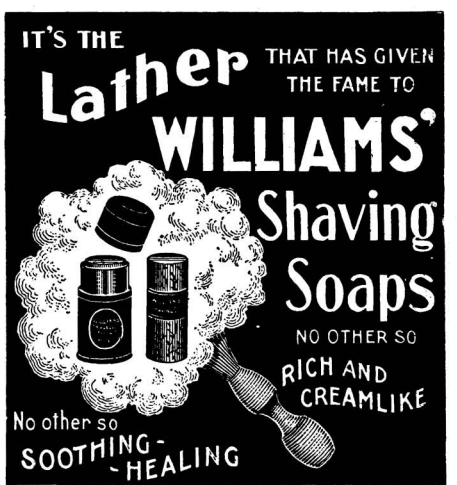

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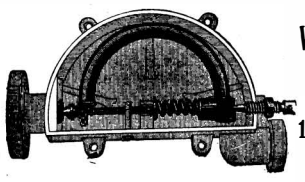

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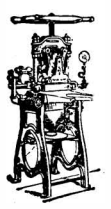

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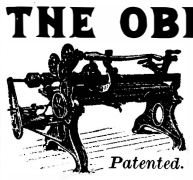

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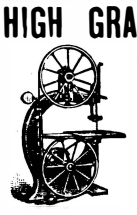

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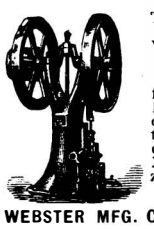

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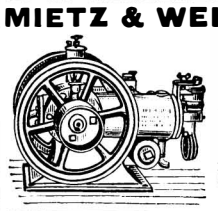

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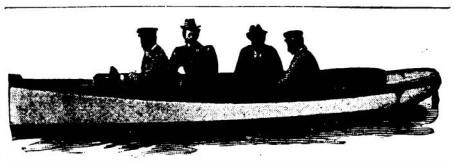

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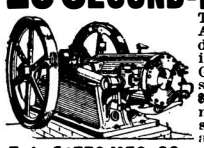

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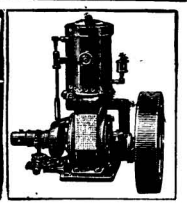

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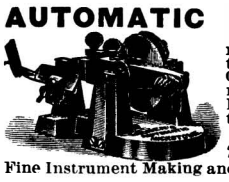

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